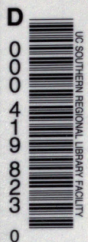


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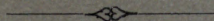


A MONOGRAPH OF THE NORWEGIAN PHYSCIACEAE

BY
BERNT LYNGE

(WITH 3 PLATES, AND II TEXT FIGURES)

(VIDENSKAPSSKAPETS SKRIFTER. I. MAT.-NATURV. KLASSE. 1916. No. 8)



CHRISTIANIA
IN COMMISSION AT JACOB DYBWAD
1916



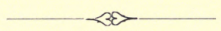
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Fremlagt i den mat.-naturv. klasses møte den 14de april 1916 ved prof. WILLE.

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Physciaceae.

Thallus membranaceous, lacinate, occasionally arbuscular, fixed to the substratum by rhizines, stratified, with *Protococcus*-gonidia.

Apothecia (in our genera) lecanorine, paraphyses septate, undivided or branched, spores brown, one-septate. Fulcra endobasidial, articulate, pycnoconidia short, straight.

The Lichen species, now referred to the genera *Physcia* and *Anaptychia*, were for the greater part referred to the genus *Parmelia* by ACHARIUS, some of them to *Borreria* or to *Lecanora*. ELIAS FRIES¹ constructed the name *Physcia* as a »tribus« of *Parmelia*, comprising our *Physcia* and *Anaptychia*, whilst our *Parmelia* was included in another »tribus« of *Parmelia*, — *Imbricaria*. *Imbricaria* was described as having »Discus . . . strato gonimo impositus«, *Physcia* as having »Discus . . . strato medullari impositus«. FRIES did not use the microscope. A microscopical investigation shows that there is a well-developed stratum of gonidia under the hypothecium in our *Parmelia*, which stratum is either wanting in *Physcia* or poorly developed, consisting of a few scattered gonidia.

KOERBER² reserved the name *Imbricaria* for our *Parmelia*, the name *Parmelia* for our *Physcia* and *Anaptychia*, and the name *Physcia* for our *Xanthoria*. MASSALONGO³ employed another nomenclature, and used the name *Anaptychia* for our *Physcia* and *Anaptychia*, making no distinction between them. His *Physcia* comprises our *Xanthoria* and *Caloplaca*, whilst his *Parmelia* agrees with our comprehension of the name.

KOERBER and MASSALONGO were among the first lichenologists to employ microscopical characters as the base of their systems, and accordingly they were able to make use of the form of the spores as an important character.

¹ FRIES, ELIAS. Systema Orbis (1825) p. 242.

² KOERBER: Systema Lichenum (1855) p. 68.

³ MASSALONGO: Memorie Lichenografiche (1855) p. 33.

Vid.-Selsk. Skrifter. I. M.-N. Kl. 1916. No. 8.

NYLANDER¹ raised the »tribus« *Physcia* (sensu FRIESII) to the rank of a genus, also comprising our *Xanthoria* on account of the spores which are one-septate in these genera. • In this last particular NYLANDER was followed by later English and French authors (CROMBIE, HARMAND, and HUE). On account of the uncoloured spores TH. FRIES² separated *Xanthoria* from *Physcia*. His genus *Physcia* comprised our *Physcia* as well as *Anaptychia*, but later on he separated them as subgenera³, being well aware of the importance of the anatomy of the thallus.

All the above authors were of the opinion that the *Physciaceae* and the *Parmeliaceae* were nearly related families. In the meantime the theory of the evolution of species began to free several of the former great sections of systematic botany, which were henceforth to be regarded as polyphyletic sections. — From different origins the plants had assumed convergent forms, either due to cognate reaction on the same exterior circumstances, or to cognate and innate tendencies of variation.

Thus the large section *Lichenes Phylloblasti* KBR. was regarded as the most highly developed representative of different series of evolution. In some cases the pedigree is relatively clear, in many cases not. There are very few fossile Lichens, for the highly transient thallus of the Lichens does not contain parts capable of preservation during geological periods.

The fundamental work by WAINIO: Étude sur la classification des Lichens du Brézil (1890) is based on the modern view, which is theoretically considered by REINKE in his Abhandlungen über Flechten IV—V (1895—1896), and constructed in detail by ZAHLBRUCKNER in Die Natürlichen Pflanzenfamilien (1907).

WAINIO draws up a section *Buellieae*, comprising the genera *Anaptychia*, *Physcia*, *Pyxine*, *Rinodina*, and *Buellia*. *Physcia* is removed from relationship with the other foliaceous Lichens, and — on account of the dark, septate spores — placed with the above mentioned genera, gathered from very different parts of the old system. REINKE follows WAINIO, only using the name *Physciaceae* instead of *Buellieae*. ZAHLBRUCKNER divides the section into two families: *Buellieaceae*, comprising the two crustaceous genera *Buellia* and *Rinodina*, and *Physciaceae*, with the three foliaceous genera *Pyxine*, *Physcia*, and *Anaptychia*.

¹ NYLANDER: Classif. 2, p. 174.

² FRIES, TH.: Lichenes Arctoi (1860) p. 66.

³ FRIES, TH.: Lich. Scand. I. (1871) p. 132 et 135.

The early authors attached great importance to the position of the gonidia in the apothecia. If the apothecia contained gonidia, they were called lecanorine, and if not, lecideine. On this basis *Buellia* was referred to the lecideine, the other genera to the lecanorine Lichens. Modern systematists, however, have more strongly emphasized the importance of the spores.

A related series of evolution, the *Theloschisteae*, was already in 1871 drawn up by the Norwegian lichenologist J. M. NORMAN, on the same principles: »Teloschistei sunt Heterolichenes sporis hyalinis . . . in locula remotiora 2 v. 4 constrictis«¹. This section comprises our genera *Blastenia*, *Caloplaca*, *Xanthoria*, and *Theloschistes*, accordingly Lichens with lecideine as well as with lecanorine apothecia. ZAHLBRUCKNER also divides this family into two families: *Caloplacaceae* with two crustaceous genera *Blastenia* and *Caloplaca*, and *Theloschistaceae* with two foliaceous genera *Xanthoria* and *Theloschistes*.

The relationship between the *Buellieae* and the *Theloschisteae* (sensu latiore) is based on morphological and anatomical characters, but there are also important biological points of resemblance, at least in the genera *Rinodina*, *Caloplaca*, *Physcia*, *Anaptychia*, and *Xanthoria*. These genera comprise species, growing under very different conditions. But it may safely be maintained that a relatively larger number of species of these genera have a greater demand for Nitrogen (N) than the species of any other series of Lichen genera. Several species, e. g. *Xanthoria lychnea*, and *Physcia tribacia*, in part also *Caloplaca elegans*, are directly ornithocoprophilous, and together with *Ramalina strepsilis* characteristic of prominent rocks and large stones on our high mountains, and (with *Rinodina balanina* and *Lecanora straminea*) of the shores of Northern Norway with their innumerable birds and millions of drying fish. Even if the birds are less numerous, and there is no drying fish, (as in Western and Southern Norway) there is an ample supply of Nitrogen by the shore, and a rich flora of *Anaptychia*, *Physcia*, and *Xanthoria* species.

The fundamental work on the nitrophily of the Lichens was written by SERNANDER² who frequently deals with Lichens of these genera.

It is well known that several species of these genera have a rapidity of growth far beyond what is usual among Lichens. Exact and copious

¹ NORMAN, J. M.: Conjectura de affinitate Heterolichenum (1871) p. 16.

² SERNANDER: Studier öfver lafvarnes biologi 1. Nitrophile lafvar (1912).

dates on this point have not been published, but every lichenologist has seen fertile *Xanthoria* on twigs of *Picea excelsa*, only a few years old, and *Physcia virella* and *Xanthoria parietina* are among the species which first cover the stems of many deciduous trees (*Fraxinus* and *Populus*). We also know BONNIER's¹ cultures of Lichens; he succeeded in obtaining fertile *Xanthoria parietina* and *Physcia stellaris* after 2—3 years.

It is not probable that these Lichens grow so quickly on account of rich nutriment. Many other Lichens perish under the same conditions, the ample supply of Nitrogen being directly poisonous to them. Other Lichens are not injured, but are unable to profit by it. We must assume that the quick growth of these Lichens is due to innate qualities, but a quick growth is not possible without sufficient food.

The excrement of birds also contain Phosphorus. I have seen no investigations of the relative importance of Phosphorus and Nitrogen to coprophilous Lichens.

We do not know much of the change of matter of the Lichens, but it is probable that some related substances are built up by nitrophilous Lichens. On the whole, Lichens are not much subject to attack by insects, but some genera and species are difficult of preservation. If not well disinfected there is little hope of preserving *Rinodina balanina* intact, and further, many *Caloplaca*-species (*Gasparrinia*), *Xanthoria*, especially *X. lychnea*, certain *Physcia* and *Anaptychia* are difficult. We must accordingly infer, that these nitrophilous or even coprophilous Lichens contain some substance which the herbarium insects can utilise; it is not unjustifiable to place this fact in relation to their similar nourishment.

A fuller investigation of the change of matter of the Lichens is much desired, but difficult on account of the slow course of their processes of life. It is possible that the *Buelliae* (sensu latiore) with their relatively quick growth, would offer the best material for such investigations.

The so-called »cortex« is the most interesting feature of the anatomy of the *Physciaceae*. In *Anaptychia* the lower cortex is usually only developed near the margin of the laciniae, and wanting along the median line. In *Physcia* it is developed over the whole lower side, in some species well set off from the medulla, in others gradually transformed into it. The hyphae are more or less parallel to the surface, only in exceptional cases apparently cellular.

In *Physcia* the hyphae of the upper cortex have a different texture in the various species, but usually they are more or less per-

¹ BONNIER: Recherches sur la synthèse des lichens (1889), p. 19.

pendicular to the surface. They are branched, at least at the base, and the branches sometimes have an oblique direction, interfering with their originally parallel position. If the branching is marked and the hyphae very densely interlaced, a cellular structure is formed. This structure is called plectenchymatous after LINDAU¹. The term pseudoparenchymatous is objectionable for the reason that it comprises two textures of very different origins, e. g. the hyphae of fungi and the short (parenchymatous) cells of higher plants. — The medullary hyphae are usually loosely interlaced, in rare cases (thin thalli) they are apparently plectenchymatous, e. g. in *Physcia sciastrella*. A thin section, and a drop of potassium hydrate will show their real texture.

In *Anaptychia* the upper cortex is very different from that of *Physcia*, the hyphae being parallel to the surface, instead of perpendicular. The cortex is darker at the exterior than in the interior, but this colour is removed by potassium hydrate, and is merely due to the adspersity of the hyphae. There is no structural limit between the exterior and the interior part of the cortex, and it is not justifiable to reserve the name »cortex« for the exterior part. Neither is there any definite limit between the cortex and the medulla. Towards the surface, the hyphae are more thick-walled and more densely interlaced, forming a protective stratum over the interior and less resistant textures. In the genus *Anaptychia* it is, accordingly, not necessary to distinguish between a cortex and a medulla from a stratigraphical point of view, and if a distinction should be made, it seems justifiable to use the term pseudocortex. By this term is then meant an exterior stratum, gradually connected with the medulla without any distinct line of demarcation.

We should gain a more general point of view of the anatomy of the Lichens on an anatomical-physiological base: The exterior part of the thallus either entirely agrees with the interior part (lower middle-line of the laciniae of most *Anaptychia*), or it is formed by a protective stratum, in its most original form consisting only of more thick-walled and more densely interlaced hyphae (pseudocortex), in other cases differentiated as a special stratum with a peculiar structure (cortex).

The first botanists who constructed the anatomy on a physiological base, were SCHWENDENER and his pupils. Their ideas have found a wide application in the study of the vascular plants and in part in that of the algae². It would be very attractive to investigate the Lichen-thallus on this basis, but that is beyond the scope of the present work.

¹ LINDAU: Beiträge zur Kenntn. d. Gatt. Gyrophora, p. 28.

² WILLE, N.: Bidrag til Algernes physiologiske Anatomie (1883).

In *Physcia*, the gonidia are placed in a stratum under the upper cortex, in *Anaptychia* they are deeply immersed in the thallus. In some species, e. g. *Physcia stellaris*, the surface of the stratum is relatively even, in others, e. g. *Ph. aipolia* and *Ph. caesia*, it is more uneven, the gonidia being glomerate, and the glomeruli not always continuous. A moistened thallus will then seem marbled, green spots (gonidia) on an uncoloured ground. This is also the case with several *Parmeliae*, e. g. of the *cetrata*-section. If the thallus is dorsiventral and appressed there are few gonidia — if any — at the lower part of the medulla. Erect or ascendant laciniae, however, offer an opportunity for assimilation also to the lower side, and gonidia are then frequently found within the lower cortex (if uncoloured). — In the apothecia, the gonidia are crowded in the margin, usually also within the cortex of the receptacle, but wanting or very poorly developed under the hypothecium. In a few species only there is a regular stratum of gonidia under the hypothecium. This must depend on organisatory peculiarities of the *Physciaceae*, for in the *Parmeliaceae* the hypothecium is seen resting on a stratum of gonidia. — There is frequently a dark zone of the cortex around the peduncle; the gonidia are then wanting within that zone.

The paraphyses are imbedded in a gelatina which in many species is very firm, especially at the epithecium. A drop of potassium hydrate will contribute to their isolation, which in many cases is not easily accomplished. The greater part of the paraphyses is undivided, but in all the Norwegian species there is a varying number of furcate or branched paraphyses in every mature apothecium. — The spores are dark, one-septate, only quite exceptionally three-septate, and simple spores were never seen. They are straight or slightly fabiform, broadly or narrowly rounded at the ends; in some species constricted at the septum, in others not. The septum and the cell-wall are more or less incrassate, leaving a cell-room of different form, varying from a narrow fissure across the spore to a large rounded space. In the cell-wall there are two strata: a narrow exterior one of uniform thickness, and an interior one of very variable thickness. — The pore is distinct in young spores, but not always in old ones; it is evidently frequently filled up with an opaque substance.

On the whole, the *Physciaceae* are lowland species in our country. There is only one real mountain species (*Ph. muscigena*) which is frequent on the mountains and rare on the lowlands of Southern Norway, and frequent in all elevations in Northern Norway. — On the mountains we also find *Ph. tribacia*, *Ph. lithotea*, and *Ph. caesia*, but with the exception of a few alpine forms

these species are quite as frequent or even more so in the lowlands. The richest flora of *Physciaceae* is found on maritime and subalpine rocks, and on the bark of certain deciduous trees (*Populus*, *Alnus*, *Fraxinus*).

There is a greater number of species in Southern than in Northern Norway. On the other hand the number of individuals is greater at some places in Northern Norway (maritime rocks, and the vast *Alnus incana* forests along the rivers). There is no Atlantic species among the *Physciaceae*, and the *Physcia* flora is better developed in Eastern than in Western Norway. — The Trondhjem district and the southern part of Nordland have been but poorly investigated. This is deplorable, for several species have their northern limit of distribution in those provinces.

Anaptychia ciliaris (the type) is a south-eastern species, northern limit Trondhjem; the var. *melanosticta*, however, is distributed along our whole coast. This is probably also the case with *An. fusca*. *An. speciosa* is a rare species of southern continental distribution.

The *Physcia caesia*-section is well represented in the whole country, as is also the *Ph. stellaris*-section with the exception of *Ph. ascendens* and *Ph. tenella*, the former species being only recorded as far north as Trondhjem, the latter (type) to Lofoten and — single specimens to — Tromsø; its var. *marina*, however, is found all along our coast. *Physcia pulverulenta* is a south-eastern species, poorly represented in Western and Northern Norway. *Physcia grisea* is exclusively southern, *Ph. obscura* and *Ph. virella* are rare north of Trondhjem, and north of Lofoten the latter is only recorded on rocks. *Ph. lithotea* is equally frequent everywhere, *Ph. endococcina*, *Ph. sciastrella* and *Ph. tremulicola* are rare southern species, the former recorded in a single specimen as far north as Harstad.

This monograph is chiefly based on the collections of the Botanic Museum of Kristiania. I have also borrowed valuable material from the Botanic Museums of Upsala (herb. TH. FRIES), Helsingfors (herb. NYLANDER), Bergen and Trondhjem, and from Mr. J. J. HAVAAS, Granvin in Hardanger. My old teacher, Dr. ZAHLBRUCKNER, Vienna, has unfailingly assisted me by word and deed, Mr. WAINIO, Helsingfors, sent me some authentic specimens, Mr. G. EINAR du RIETZ, Stockholm, gave me information concerning Swedish *Physciae*. Miss A. L. SMITH, London, has rendered literary help, and Mrs. JOHANNE KRAFFT LYNGE, has drawn the figures and assisted in the reading of the proof-sheets. — I desire to express my profound gratitude to the directors of the above mentioned museums, and to all the scientists and others who have rendered me their greatly appreciated help.

It is well known that the nomenclature of the *Physciaceae* is very intricate. Many questions cannot be settled without a study of the authentic specimens, and owing to the present unsafe communications it was impossible to obtain an inspection of more than a few of them. — The more thanks are due to Prof. ELFVING and to Dr. WAINIO, Helsingfors, who risked some of their specimens. — But to a great extent I was obliged to confine my task to describing the species and varieties of the available material and to rendering an account of their distribution and biology.

The geographical names will be found on Mr. NISSEN's excellent maps of Norway ¹ (with Index of Names).

Genera.

Thallus with an upper pseudocortex, consisting of hyphae which are parallel to the surface.

I. *Anaptychia*.

Thallus with an upper cortex, consisting of hyphae, perpendicular to the surface.

II. *Physcia*.

This family also comprises a third genus, *Pyxine*, with lecideine apothecia, distributed in exotic countries, and in North America.

I. *Anaptychia* KBR.

Anaptychia KOERBER Systema Lichenum (1855) p. 49. ZAHLBRUCKNER Lichenes (Flechten) B. Specieller Teil, in ENGLER u. PRANTL Die natürlichen Pflanzenfam. I 1* (1907) p. 236.

Syn. BORRERA ACH., HAGENIA ESCHW., PHYSCIA * ANAPTYCHIA TH FR., *Pseudophyscia* MÜLL. ARG.

Thallus (in our species) large, laciniae multifid, elongate, upper pseudocortex formed of densely interlaced hyphae, which are parallel to the surface, lower pseudocortex of the same texture, well developed at the margin of the laciniae, less developed or wanting at the middle. Gonidia (according to ZAHLBRUCKNER l. c.) *Protococcus*.

¹ Oberst NISSEN's Kart over det sydlige Norge (1:600 000, 4 parts), and his »Kart over det nordlige Norge« (1:1 000 000).

Apothecia large, gonidia glomerate, placed in the margin and (in *Anapt. fusca*) under the hypothecium or (in *Anapt. speciosa* and *Anapt. ciliaris*) within the pseudocortex. Hypothecium pale. Paraphyses easily discrete, thin, incrassate at the apices, septate, undivided or not unfrequently furcate or branched towards the apices. Asci octosporous. Spores brown, one-septate, ellipsoidal, constricted at the septum, large (ca. $25-40 \times 13-20 \mu$).

Perifulcrum dark at the ostiolum, otherwise uncoloured, or darkened with age, fulcra endobasidial, pycnoconidia short, straight, cylindrical or narrowly ellipsoidal.

Chemical reaction. No colouring by CaCl_2O_2 . Reaction with KOH important, characteristic of the species. Hymenium first blue by J, then sordid vinous red, asci sometimes persistently blue.

Clavis specierum.

- | | |
|---|-----------------------------|
| 1. Thallus brown. | 1. <i>Anapt. fusca</i> . |
| 1* Thallus white or grey. | |
| 2. Thallus white, sorediate, without marginal cilia, KOH yellow. | 2. <i>Anapt. speciosa</i> |
| 2* Thallus greyish, not sorediate, with spreading marginal cilia, KOH negative. | 3. <i>Anapt. ciliaris</i> . |

1. *Anaptychia fusca* (HUDS.) WAIN.

Lichen fuscus HUDSON Flora Anglica edit. II (1798) p. 533. WAHLENBERG Flora Lapponica (1812) p. 426.

Lichen aquilus ACHARIUS Prodomus (1798) p. 109.

Parmelia aquila ACHARIUS Methodus (1803) p. 201. ACHARIUS Lichenographia Universalis (1810) p. 488. KOERBER Systema Lich. Germ. (1855) p. 89. JATTA Sylloge Lich. Ital. (1900) p. 144.

Anaptychia aquila MASSALONGO Memorie lichenogr. (1853) p. 36, fig. 31.

Physcia aquila NYLANDER Prodomus Lich. Gall. Actes de la Soc. Linn. de Bord. (1857) p. 309. NYLANDER Synopsis Lichenum vol. I (1860) p. 422. TH. FRIES Lich. Arctoi (1860) p. 62. NYLANDER Lich. Scand. (1861) p. 110. TH. FRIES Lich. Scand. I (1871) p. 134. KINDT Bidrag til Kundskab om Trondhjems Lavvegetation. Kgl. Norske Vid.-Selsk. Skrifter (1880) p. 29 (Trondhjem 1881). CROMBIE Brit. Lich. I (1894) p. 310. HAVAAS Floristiske undersøgelser. Berg. Mus. Aarb. 1897, no. III, p. 9. GLÜCK Morpholog. d. Flechtenspermog. Verh. des Naturhist.-Mediz. Vereins zu Heidelberg. vol. VI. N. F. (1899) p. 146 (66) fig. 37—38. OLIVIER

Lichens d'Europe (1907) p. 234 (158). GALLOE Danske Lich. Økol. Bot. Tidsskr. vol. XXVIII, 1908, tab. XV fig. 78. LYNGE De norske blad-og busklaver. Berg. Mus. Aarb. (1910) no. 9, p. 99.

Pseudophyscia aquila. HUE Lichenes Extra-Europ. Nouv. Arch. Mus. sér. IV, tom. I (1889) p. 116. HARMAND Lichens de France (1909) p. 488.

Anaptychia fusca WAINIO Lich. Cauc. Termesztér. füzetek vol. XXII (1899) p. 299.

EXSIC. ANZI Lich. Etrur. 10 (*Parm. Aquila*). ANZI Lich. Lang. 10 (*Parm. Aquila*). ARNOLD Lich. EXSIC. 705 (*Parm. Aquila* var. *stippaea*). CLAUD. et HARM. Lich. Gall. praec. 235 (*Physcia aquila*). FRIES Lich. Suec. 208 (*P. Aquila*). HAVAAS Lich. Norv. 380 (*Physcia Aquila*). HEPP Flechten Europa 602 (*Lobaria aquila*). LEIGHTON Lich. Brit. 144 (*Parm. Aquila*). LOJKA Lich. Univ. 10 (*Physcia Aquila*). MASSALONGO Lich. Ital. 87 (*Squamaria Aquila*). NYLANDER Pyren. Orient 28 (*Physcia Aquila*). RABENHORST Lich. Europ. 586 (*Hagenia Aquila*). SCHAEERER Lich. Helv. 565 (*Parm. Aquila*). STENHAMMAR Lich. Suec. 43 (*Parm. aquila*). ZAHLBR. Krypt. Exsic. Vindob. 2179 (*Anapt. fusca*).

Thallus large, up to 20 cm. in diam., loosely affixed to the substratum, rather firm, but fragile. Laciniae discrete at the circumference, otherwise densely contiguous or imbricate, or even interlaced and congested. Laciniae parallel to the substratum or towards the centre slightly ascendant, stellate, narrow, 0.5—1 (2) mm. broad, linear, elongate, multifid, repeatedly furcate, or short, unbranched to almost papillaceous. Laciniae more or less convex, flattened at the circumference of the thallus, with regular contours and minutely rugulose or even surface, epruinose or rarely slightly bluish pruinose. Secondary laciniae well developed, short, narrowly fixed, unbranched, papillaceous or digitately incise, towards the centre occasionally covering the whole thallus, giving it a microphylline appearance. Thallus opaque, rarely with a faint lustre, colour chestnut brown or greyish brown, at the circumference paler, wetted with a strong tinge of green. (Morbid plants discoloured, greyish or greyish-white, old herbarium specimens often intensely castaneous). Lower side uncoloured or greyish-white or yellow at the circumference, otherwise brownish black or black. Rhizinae scattered, black, unbranched or furcate, 80—95 μ thick.

Thallus covered with a thin, amorphous stratum. Gonidia glomerate, disposed in an incontinuous irregular stratum, 180—190 μ thick, sometimes

protruding towards the surface, sometimes deeply immersed in the medulla. Pseudocortex of a variable thickness, 40—160 μ thick, yellowish brown at the exterior part, otherwise uncoloured. Hyphae rather thick-walled, densely interlaced, especially towards the surface, more or less parallel to the surface. Medulla white, not distinctly marked off from the cortical strata. Towards the lower side the hyphae are more densely interlaced and thick-walled, uncoloured at the circumference of the thallus, otherwise brownish-black.

Apothecia numerous, sometimes covering the whole central part of the thallus, sessile, orbicular or angular, 1.5—3.5 mm. in diam., naked, plane, brownish-black or black. Receptacle paler than the thallus, yellowish or yellowish-brown rugulose. Margin thick, persistent, crenate, occasionally appendiculate. At the exterior part of the receptacle the hyphae are more densely interlaced and have thicker walls than at the interior part. Gonidia glomerate, very crowded in the margin, and in a thick stratum under the hypothecium. Hymenium thick, 200—270 μ , brownish at the exterior part, otherwise uncoloured. Paraphyses easily discrete, at the apices clavately incrassate (3—4 μ thick), indistinctly septate, undivided or more or less branched, frequently with oil-drops, especially in the tips of the short lateral branches. Asci thick-walled, 120—135 μ long, 35—42 μ thick, octosporous. Spores obliquely biserial, first uncoloured, finally opaque, deep brown, straight or slightly fabiform, rounded at the ends, constricted at the septum, 31—51 μ long, 18.5—25 μ thick (usually 40—44 \times 18.5—21 μ)¹.

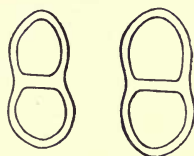


Fig. 1. *Anaptychia fusca*
(Huds.) WAIN

Pycnides very rare (I have only found one sterile pycnide). After Harmand l. c. »Spermaties bacillaires, obtuses à chaque bout, 0,006—7 \times 0,0008.«

React. Cortex and medulla uncoloured by KOH as well as by CaCl_2O_2 . Hymenium blue by J, asci persistently blue, paraphyses and gelatine later blackish or dark sordid red.

Hab. Grows on maritime rocks above the high-water mark. On the humid Atlantic coast it is also recorded at 1 or 2 km. from the shore, not exposed to the sprinkling of the water; also recorded at the base of the trunks of trees.

¹ After CROMBIE and TH. FRIES: 30—44 \times 18—25, HARMAND: 32—35 \times 18—26, JATTAL: 32—44 \times 18—26, NYLANDER: 32—44 \times 18—26.

Loc. Abundant along the south and west coast, rare towards the inland end of the western fjords. Frequent as far north as Lofoten, north of Lofoten more scattered; not recorded from Varanger. — South coast: Hvaler (LYNGE), Fredriksstad (SCHÜBELER), numerous stations about Kristiania (MOE), Vasser (LYNGE), Nevlunghavn (MOE), Helgeroen (F. KLÆR), Lyngør (LYNGE). West coast: Kristianssand (LAUDER LINDSAY), Sogndalsstranden (HAVAAS), Stavanger (BLYTT), Moster (HAVAAS), Granvin and Manger (HAVAAS), Sunde near Luksund (HAVAAS), Seim (LYNGE), Florø and Stat (HAVAAS). Trondhjem: Ladehammern (KINDT) and Stordalen (SOMRFT.). Northern Norway: Alstahaug (M. N. BLYTT) Gildeskaal (NORMAN) and Grønholmen (SOMRFT.) in Salten, Bodø (HAVAAS), Steigen (NORMAN), Lofoten (BLYTT), Hadseløen (NORMAN), Tromsøen (LYNGE), Øxfjord (BAUR), Maasø (TH. FRIES), and Honningsvaag (LYNGE).

Anaptychia fusca varies: Laciniae broad, but slightly convex, thallus pale brown (f. *crossophylla* (WBG.) ACHARIUS Lich. Univ. p. 488), and laciniae narrow, densely interlaced, imbricate or panniform, thallus dark brown (f. *stippea* Ach. Lich. Univ. 489). These forms are interesting as indicating the variation of the species, but insignificant as systematic units, being connected with the type by numerous intermediate states. In the specimens which I have seen the marginal »granulae« of f. *crossophylla* are only small secondary laciniae, not isidia. The form cannot possibly be referred to *Anaptychia detonsa*, as represented by MERRILL in his Lich. Exs. no. 252. *Anaptychia detonsa* has not been recorded from Norway.

2. *Anaptychia speciosa* (WULF.) MASS.

Lichen speciosus WULFEN Plantae rariores Carinth. in JACQUIN Collectanea vol. III (1789) p. 119, tab. 7. ACHARIUS Prodrumus (1798) p. 124.

Parmelia speciosa ACHARIUS Methodus (1803) p. 198. ACHARIUS Lichenographia Universalis (1810) p. 480. FRIES, El. Lichenogr. Europ. reform. (1831) p. 80. KOERBER Syst. Lich. Germ. (1855) p. 89.

Anaptychia speciosa MASSALONGO Memorie Lichenografiche (1855) p. 36 fig. 32. WAINIO Étude sur . . . les Lichens du Brésil. Acta Soc. pro Fauna et Flora Fennica vol. VII (1890) p. 135. DALLA TORRE et SARNTHEIM Die Flechten von Tirol (1902) p. 155.

Physcia speciosa NYLANDER Prodrumus Lich. Gall. Actes Soc. Linn. Bord. (1857) t. XXI p. 307. NYLANDER Synopsis (1860) p. 416. NYLANDER Lich. Scand. Not. Sällsk. Fauna et Flora Fenn. Förh. vol. V (1861) p. 109. TH. FRIES Lich. Scand. I (1871) p. 133. CROMBIE Brit.

Lich. I (1894) p. 304. OLIVIER Étude sur les . . . Physcia. Revue de Botanique (1894) p. 82. OLIVIER Lichens d'Europe (1907) p. 157 (233) LYNGE De norske blad- og busk-laver. Berg. Mus. Aarb. 1910 no. 9, p. 99.

Hagenia ESCHW. *Hagenia speciosa* SCHWENDENER Untersuchungen über den Flechtenthallus in NÄGELI Beiträge II Leipzig 1860, p. 162.

Pseudophyscia speciosa. MÜLL. ARG. Conspectus Lich. Nov. Zeland. Bull. Herb. Boiss. II, append. I (1894) p. 40. HUE Lich. Extra-Europ. I. Nouv. Arch. Mus. sér III, vol. X (1898) p. 114. HARMAND Lichens de France (1909) p. 487.

EXSIC. ANZI Lich. Lang. 56. ARNOLD Lich. EXSIC. 1611 a, b. FUNCK Krypt. Gewächse 580. KOERBER Lichenes selecti 156 RABENHORST Lich. Eur. 426, 908. SCHAEERER Lichenes Helvetici 357. TUCKERMAN Lichenes Amer. Septentr. 81.

Thallus large, 10–20 cm., orbicular or irregular, loosely appressed to the substratum, pliable. Laciniae continuous from the centre, elongate, linear, 1–2 mm. broad, a little widened towards the apices, multifid, pinnato-incise or digitato-ramose with rounded axillae, discrete or subdiscrete, but with more or less imbricate lateral branches. Laciniae epruinose, without isidia, but sorediate at the apices of the lateral branches, sorediate apices in age occasionally ascendant or suberect, forming capitate soredia. Laciniae smooth, plane, with a faint horny lustre, colour white or greyish-white, moistened greyish-green, lower side white. Laciniae at the margin with unbranched scattered, 0.5–1 mm. long cilia of the same colour as the thallus, rhizinae much branched, uncoloured at the circumference of the thallus, otherwise dark.

Thallus covered with a thin, amorphous, uncoloured, interspersely broken stratum. Pseudocortex formed of thick-walled hyphae which are parallel to the surface and more densely interlaced towards the surface. Pseudocortex greyish at the superior part (20–40 μ), otherwise uncoloured, of a very variable thickness (25–150 μ). Gonidia glomerate, disposed in an irregular, thin, subcontinuous stratum under and also, though scattered, in the upper pseudocortex. Medulla white, hyphae loosely interlaced, rather thin-walled, adspersed. Medulla gradually transformed into a lower uncoloured pseudocortex of the same structure as the upper one, well developed near the margin of the laciniae, thinner, less developed and in part wanting towards the middle. Rhizinae much branched, tomentose, 50–100 μ thick.

Apothecia very rare, at least in this country, but numerous or even abundant when developed, urceolate or later concave, orbicular, 2—4,5 mm. in diam. sessile or shortly pedicellate, narrowly affixed. Receptacle smooth, of the same colour as the thallus, margin middle-thick, crenate, but not appendiculate, at last sorediate. Disc brown or brownish-black, epruinose. Gonidia glomerate, disposed in an incontinuous stratum, crowded at the margin and within the pseudocortex, wanting under the hypothecium. Hypothecium pale yellowish, 40—60 μ thick. Hymenium up to 130 μ thick, at the upper part brown or reddish-brown, otherwise uncoloured. Para-

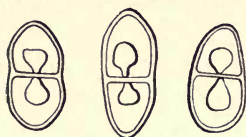


Fig. 2. *Anaptychia speciosa*
(WULF.) MASS.

physes more conglutinate than in *An. fusca*, filamentose, 1 μ thick, a little incrassate at the apices, unbranched or (frequently) furcate. Septa distinct only toward the apices. Asci clavate, 90—105 μ long, 29—32 μ thick, octosporous. Spores obliquely biserial, ellipsoidal with more or less obtuse apices, greyish or greyish-brown, somewhat constricted at the septum, very thick-walled, with a small rounded or angular cell-room. Size 28—37,3 μ long, 13,5—18,8 μ thick. (WAINIO measured smaller spores in Brazilian plants 19—32 \times 10—17 μ)¹.

Pycnides very rare; fertile ones were sought after in vain. A sterile pycnide with dark perifulcrum around the ostiolum was depresso-globose, 160 μ broad, 105 μ high. (WAINIO states: pycnoconidia cylindrico-oblonga, apicibus obtusis, recta, long. 0,003, crass. 0,001—0,0008 millim.)².

React. Pseudocortex and (especially) medulla yellow by KOH. No colouring by CaCl_2O_2 . Medulla first pale blue, then — at last intensely — vinous-red by J, near the rhizinae sometimes persistently blue. Hymenium intensely dark bluish-green or bluish-black, later dark red by J. (WAINIO has found: Hymenium Jodo persistenter caeruleus)³.

Hab. In this country only recorded from mossy stones (in southern regions also corticolous).

Loc. In Norway a subalpine and occasionally a lowland species. Recorded from several stations, but in small quantities, and is decidedly a rare species. — Kristiania (M. N. BLYTT, never found since), not unfrequent in Gudbrandsdalen: Ringebu (c. fr., M. N. BLYTT and SOMRFT.), Fron (KLÆR), Kringen (TH. FRIES who writes »Kringelen«), Lalm (LYNGE), Vaage (c. fr., SOMRFT.), Dovre (c. fr., M. N. BLYTT et SCHIMPER), Valdres: .

¹ WAINIO Étude p. 136—137.

² WAINIO Étude p. 137.

³ WAINIO Étude p. 136.

Stee («Steie») in Vestre Slidre (M. N. BLYTT), Beito in Østre Slidre (M. N. BLYTT), and Grindadn («Grindsfjeldet») in Vang (M. N. BLYTT), Filefjeld (M. N. BLYTT), Telemarken: Haakenes (M. N. BLYTT), det. E. FRIES: »rarissime in Europa borealis, antea non visa«, herb. note by FRIES). Very rare in Western Norway, only recorded from Vaagsø in Nordfjord (C. G. MYRIN) — TH. FRIES erroneously writes ¹« Steie (BLYTT) distr. Bergensis«, Steie or Stee is in Valders.

The eminent observer Mr. HAVAAS has carefully investigated our west coast from Stat to Rægefjord and never found it, and it is, therefore, improbable that this conspicuous species should be recorded from that region. It has neither been recorded from our south-eastern lowlands, Hedemarken, Hadeland, Kristiania-fjord (with the one exception of BLYTT's locality), nor from the south coast. It will be seen that *An. speciosa* is characteristic of the upper part of our great south-eastern valleys, there is only one maritime locality: Vaagsø.

It is possible that this distribution is only due to historical causes, that soredia or thallus fragments were first brought to one of these stations, and that it was only spread to continental localities. — This explanation is not very satisfactory from a scientific point of view. The valleys have a dry climate, but Vaagsø has an annual downpour of ca. 2000 mm., and the plant is known from Western France and from the British Isles, where it is recorded »chiefly in maritime districts«². — The importance of the annual rain-fall has in our literature been overestimated. There are dry and humid places everywhere, notwithstanding the rain-fall, and plants growing scattered and in inconsiderable numbers will not be much influenced by it. — The downpour is of extreme importance to the development of extensive formations. If the rain is so heavy and constant that *Sphagna* grow on smooth mountain-sides, as in Western and in part in Southern Norway, the Lichens will have a poor chance of covering the ground, and it is very rare that we find a Lichen-formation of 100 m. in extension, with the exception of the special shore formations of *Gyrophora*, *Umbilicaria*, and *Xanthoria*-species. In the continental parts of Eastern Norway (Fæmunden with a downpour of 4–600 mm.) and the adjacent parts of Sweden (Dalarne) there are almost continuous formations of Lichens, more than 100 km. in extension (*Cladonia alpestris* and *C. silvatica*).

If the distribution of our plant should have a climatic cause, we must

¹ TH. FRIES: Lich. Scand p. 134.

² CROMBIE: l. c. p. 304.

consider temperature. Within certain limits the cold of winter is not pernicious, for it is recorded from places in Central Europe with a low winter temperature (Black Forest, Tirol).

Probably the summer temperature (May—September) is the decisive factor. *Anapt. speciosa* in our country grows farther north than in any other country. In southern countries *An. speciosa* grows on bark and on mossy rocks. In Norway it is only recorded as muscicolous, which is generally considered an indicium that a Lichen grows near its climatic limit. In our country *An. speciosa* certainly requires as much warmth as it can obtain. The temperature is to a large extent dependent on exposure to the sun. But owing to the vicinity of the great mountain masses the summer temperature is higher at the upper parts of our valleys than at the lower parts and on the plains.

If the summer temperature should be a decisive climatic factor for the distribution of some Lichens, we might expect to find other Lichens limited by summer isotherms. The discussion of this interesting point must, however, be deferred to a later work.

3. *Anaptychia ciliaris* (L.) MASS, KBR.

Lichen ciliaris LINNÉ Species plantarum (1753) p. 1144. GUNNERUS Flora Norvegica vol. II (1772) p. 58. Flora Danica (1777) tab. 711. WULFEN Plantae rariores Carinth. in JACQUIN Collectanea vol. IV (1790) p. 244. ACHARIUS Prodromus (1798) p. 173. HUDSON Flora Anglica ed. II (1798) p. 538.

Parmelia ciliaris ACHARIUS Methodus (1803) p. 255.

Physcia ciliaris DECANDOLLE Flore de France II (1803) p. 396 (non vidi). SCHAEERER Enumeratio critica (1850) p. 10 tab. II fig. 1. NYLANDER Lich. Scand. (1861) p. 108. DEICHMANN BRANTH et ROSTRUP Lichenes Daniae (1869) p. 63 (Sep. of Botanisk Tidsskrift vol. III). TH. FRIES Lich. Scand. I (1871) p. 132. CROMBIE Brit. Lich. I (1894) p. 302. OLIVIER Étude sur les . . . Physcia. Revue de Botanique (1894), p. 81 (33). OLIVIER Lich. d'Europe I (1907) p. 232. GALLØE Danske Lich. Økol. Botan. Tidsskr. vol. XXVIII, tab. XV, fig. 79. LYNGE De norske busk- og blad-laver Berg. Mus. Aarb. 1910, no. 9, p. 99, et tab. IV fig. 5.

Borrera ciliaris α ACHARIUS Lichenographia Universalis (1810) p. 496.

Hagenia ESCHW. *Hagenia ciliaris* SCHWENDENER Untersuchungen über den Flechtenthallus in NÄGELI Beiträge II (1860) p. 161, tab. V, fig. 12—13.

Anaptychia ciliaris MASSALONGO *Memorie Lichenografiche* (1855) p. 35 et fig. 27. KOERBER *Systema Lichenum* (1855) p. 50. GLÜCK *Morphol. der Flechtenspermog. Verh. des Naturhist.-Mediz. Vereins zu Heidelberg* vol. VI, N. F. (1899), p. 155 (75) fig. 45, tab. III, fig. 33—36. DALLA TORRE et SARNTHEIM *Die Flechten von Tirol* (1902) p. 154. HARMAND *Lich. de France* (1907) p. 446. LINDAU *Die Flechten, in Kryptogamenflora* (1913) p. 234 et fig. 292.

GUNNERUS cites the Norwegian name »Haar-Mosse« (Hair-lichen) which is probably merely a translation of the Latin name.

Exsic. ANZI *Lich. Lang.* 258 A, B (*B. f. crinalis*). ARNOLD *Lich. Exsic.* 580 b, c. (a not seen). CLAUD. et HARM. *Lich. Gall.* 23. FLOERKE *Deutsche Lich.* 152. FLOTOW *Lich. Exs.* 62 A, B. FRIES *Lich. Suec.* 139. FUNCK *Crypt. Gew.* 161. HAVAAS *Lich. Norv.* 452. HEPP *Flechten Eur.* 168, 571, 572, (571: β *crinalis*, 572: γ *solenaria*). MALBRANCHE *Lich. Norm.* 24. MALME *Lich. Suec.* 155. MASSALONGO *Lich. Ital.* 39, 40 (40: f. *angusta* MASS). MIGULA *Kryptogamae* 51. RABENHORST *Lich. Eur.* 63, 100 (100: f. *crinalis*). REICHENBACH et SCHUBERT 38. SCHAEERER *Lich. Helv.* 388. STENHAMMAR *Lich. Suec.* 42.

MASSALONGO's and KOERBER's works were published in the same year, 1855; I do not know which of them appeared first. ZAHLBRUCKNER writes: *Anaptychia ciliaris* (LINN.) MASS.¹

Thallus large, up to more than 20 cm. in diam., coriaceous, loosely affixed to the substratum. Lacinae elongate, 1—2 mm. broad, at the circumference parallel to the substratum, otherwise more or less ascending, spreading, imbricate or interlaced, multifid, repeatedly furcate, at the apices somewhat dilated and digitato-incise. Lacinae with recurvate margins, convex or subcylindrical, surface smooth or minutely tomentose, striate or rugulose, frequently furnished with semiglobose papillae, to 1 mm. in diam. (pycnides). Colour grey or greyish-white, moistened greyish-green, lower side white, striato-tomentose. Thallus without isidia or soredia. Lacinae at the margin with long (2—6 mm.), spreading, undivided or branched cilia of the same colour as the thallus or a little darker, especially at their apices.

¹ ZAHLBRUCKNER *Lichenes*, in ENGLER u. PRANTL *Die natürlichen Pflanzenfamilien* I 1* p. 236.

Upper pseudocortex ($30-160\ \mu$) with a thin brownish part at the surface, otherwise uncoloured, hyphae thin-walled, but densely interlaced, especially at the exterior part; many hyphae regularly growing out to hairlike, undivided, furcate or even stellately branched, to $60\ \mu$ long emergences, forming the tomentum of the thallus. Gonidia glomerate, disposed in a subcontinuous stratum under and in the pseudocortex, occasionally in the whole medulla, more rarely in the cilia. Medulla white, hyphae loosely interlaced, much branched. Lower pseudocortex like the upper one in structure, well developed near the margin, poorly developed or wanting at the middle of the laciniae; sometimes the two cortices meet, excluding the medulla.

Apothecia very numerous, pedicellate or sessile, orbicular, to 8 mm. in diam. Receptacle smooth, of the same colour as the thallus, minutely tomentose (under a strong lens). Margin thick, persistent, incurvate,

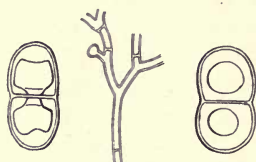


Fig. 3. *Anaptychia ciliaris* (L.).

crenate or furnished with pointed or lacerate lacinulae. Pseudocortex $40-210\ \mu$ thick, slightly darkened at the surface, otherwise uncoloured; hyphae more or less parallel to the surface and more densely interlaced at the exterior part, otherwise of no definite direction; many hyphae growing out as hair-like, pellucid emergences. Gonidia glomerate, arranged in an incontinuous stratum at the margin and within the pseudocortex,

wanting under the hypothecium. Disc plane, dark brown or brownish-black, naked or with a thin white or caesious pruina. Hypothecium greyish or uncoloured, $50-80\ \mu$ thick. Disc covered with a thin, broken, amorphous stratum. Hymenium $130-160\ \mu$ thick, at the exterior part brownish or brownish-red, otherwise uncoloured. Paraphyses easily discrete, $0.8-1\ \mu$ thick, grown-out paraphyses slightly clavately incrassate and distinctly septate at the apices, they are undivided or occasionally furcate, rarely branched from the base. Asci narrowly clavate, $105-120\ \mu$ long, $34-37\ \mu$ thick, octo- or rarely tetra-sporous. Spores obliquely biseriate, ellipsoidal or fabiform, rounded at the ends and constricted at the septum, sometimes of an irregular form (one half less developed, apices protruded &c.). Cell-wall relatively thin, cell-room large, rounded, pore distinct in young spores, indistinct or filled up in the old, opaque, dark brown or greyish black spores. Size: $26.5-44.7\ \mu$ long, $13.2-24\ \mu$ thick.

Pycnides frequent, occasionally immersed in low and broad papillae, containing one or more pycnides. Pycnides globose, large, to $300\ \mu$ in diam. Perifulcrum black at the protrudent ostium, otherwise pale or

uncoloured. Pycnoconidia straight, narrowly ellipsoidal or cylindrical, 3—4 μ long.

React.: The whole thallus unaltered by KOH as well as by CaCl_2O_2 . Hymenium first blue by J, then at last sordid bluish-black, asci subpersistently blue.

Hab. On the stems of large deciduous trees in open positions, as avenue trees or clusters of trees on cultivated ground.

Loc. Very frequent or even abundant in the south-eastern lowlands. Northern limit Trondhjem. — Abundant east of the Kristiania fjord: Fredriksstad (SCHÜBELER), Aas, Ski, and Neset (LYNGE), Aker about Kristiania (M. N. BLYTT and N. G. MOE), Bærum and Nordmarken (LYNGE), west of the fjord only recorded from Larvik (SOMMERFELT), and from Hedrum (NORMAN). South-eastern lowland: Hurdalen (SOMMERFELT), Minne (LYNGE), Trøgstad (SOMMERFELT). South-eastern valleys: Torpen in Gudbrandsdalen (KINDT), Dovre (M. N. BLYTT), Vangsmjøsen in Valdres (NORMAN), Meldalen (GUNNERUS) and Ilsviken (KINDT) near Trondhjem. Very rare in Western Norway, only recorded from Vøringfossen in Eidfjord, Hardanger, on mossy rocks (very narrow laciniae, almost the habitat of *A. leucomelaena* (HAVAAS).

Plants from more elevated situations have a dark thallus with narrow laciniae and are frequently sterile.

var. *melanosticta* (ACH.) HARM.

Parmelia ciliaris γ *melanosticta* ACHARIUS Methodus (1803) p. 255.

Borreria ciliaris var. *melanosticta* ACHARIUS Lich. Univ. (1810) p. 497.

Lichen ciliaris WAHLENBERG Flora Lapponica (1812) p. 434.

Physcia ciliaris var. *saxicola* NYLANDER Enumeration. Mém. Soc. Imp. Science Cherb. vol. V (1857) p. 106. NYLANDER Synopsis (1860) p. 414 CROMBIE Brit. Lich. I (1894) p. 303.

Physcia ciliaris var. *scopulorum* E. NYLANDER Ålands Laf-veget. Not. Sällsk. pro Fauna et Flora Fen. förh. vol. III (1857) p. 86. TH. FRIES Lich. Arct. (1860) p. 61.

Physcia ciliaris β *melanosticta* TH. FRIES Lich. Scand. I (1871) p. 133.

Anaptychia ciliaris f. *melanosticta* HARMAND Lichens de France (1907) p. 447.

Thallus large, to more than 20 cm. in diam. Laciniae imbricate, subappressed to the substratum or more or less ascendent in the centre, rather compact, rarely spreading, multifid, divaricately furcate. Colour brown or dark brown, lower side white. Laciniae narrower than in the type, 0,5—1, rarely 1,5 mm. broad, cilia dark, brown or brownish-black.

Thallus thinner than in the type. Upper pseudocortex (20) 40—80, rarely to 100 μ thick, brownish at the surface (16—20, rarely to 25 μ). Hair-like emergences rare or wanting. Gonidia crowded in an inconspicuous stratum under the upper pseudo-cortex, also in the medulla.

Apothecia rare, shortly pedicellate, epruinose, smaller than in the type, 4—5 mm. in diam. Their form and structure, paraphyses, asci, and spores as in the type (spores: 33,2—42,5 μ long, 16—21 μ thick).

Pycnides and chemical reaction as in the type.

Hab. On maritime rocks, in the *Xanthoria parietina*-zone, frequently associated with mosses, one specimen from Northern Norway (Steigen) on *Populus*.

Loc. Distributed along our whole coast from the Swedish to the Russian frontier: Vasser (LYNGE), the silurian islands near Kristiania: Næsøen, Nakholmen, Malmøen (MOE and NORMAN), Lyngør (LYNGE). Rare, but not wanting on the west coast, not recorded from the western fjords (HAVAAS). Evidently frequent, though not in great quantities, on the shores of Northern Norway: Rødø and Gildeskaal (NORMAN), Bodø (SOMMERFELT), Steigen (NORMAN), Lofoten (BARTH), Trondenes and Kvædfjord (NORMAN), Tromsø (NORMAN), Skjervø (NORMAN), Nordkap (WAHLENBERG), Børselv in Porsanger (NORMAN), Mortensnes in Varanger (TH. FRIES).

There is a certain analogy between *Anapt. ciliaris* var. *melanosticta* and *Ph. tenella* var. *marina*. Either of them is a maritime plant, nearly related to more continental plants of much more limited distribution. A wider distribution of maritime plants than of nearly related continental ones is very interesting from a biological point of view, but less important as a systematic character for the reason that we can presume a cause of it to be the more uniform maritime climate.

Numerous forms of *Anapt. ciliaris* have been proposed, but with the exception of var. *melanosticta* they are either stages of age or expressions of individual variation. 1) f. *agriopa* ACHARIUS Methodus p. 255: short, broad, palmato-incise laciniae (JACQUIN Coll. vol. IV, tab. XIII, fig. 1). 2) var. *actinota* ACHARIUS Methodus p. 256: well fertile; margin of apothecia lacerate or appendiculate. 3) var. *verrucosa* ACHARIUS Lichenographia

Universalis p. 497: pycnides numerous, frequently congested in low, semiglobose papillae. 4) *f. crinalis* (SCHLEICH.) SCHAEER. Enumeratio p. 10: very narrow, tomentose laciniae (I have never seen *f. crinalis* in Norway as distributed in ANZI Lich. Lang. 258 B).

The hair-like emergences of *Anapt. ciliaris* are found on the whole surface, especially on the cilia; at the base of the cilia the gonidia are always very numerous. The »hairs« must be looked upon as water-absorbing organs. Their efficiency is easily seen. Place a dry tomentose cilia under the glass and near it a naked cilia of the var. *melanosticta*. Add water. The tomentose cilia will absorb water momentarily, surrounding itself with a hood of water; the naked cilia also absorb water as does every fragment of a Lichen, but less quickly. The tomentose type grows on stems where every available drop of rain must be utilized; var. *melanosticta* which is most frequently naked or at least less tomentose grows on maritime rocks in humid air and is frequently sprinkled by the waves.

Var. *melanosticta* easily falls a victim to herbarium insects if not carefully disinfected. This is frequently the case with nitrophilous Lichens, and maritime Lichens are often nitrophilous. I have, however, made no special observations in nature about the nitrophily of this variety.

II. *Physcia* (SCHREB.) WAIN.

SCHREBER Gen. Pant. II (1791) p. 767 p. p. WAINIO Étude sur la classif. . . . des lichens du Brésil. Acta Soc. p. Fauna et Flora Fennica vol. VII (1890) p. 138 (ubi syn.). ZAHLBRUCKNER Lichenes (Flechten) B. Spezieller Teil, in ENGLER u. PRANTL. Die natürlichen Pflanzenfam. I 1* (1907) p. 234.

Syn. *Borreria* ACH. p. p., *Dimelaena* b. *Phyllohallae* NORM., *Parmelia* KBR., *Squamaria* MASS. —

Thallus of varying size, laciniae multifid, elongate or short, upper cortex formed of hyphae more or less perpendicular to the surface, in some species plectenchymatous, hyphae constrictedly septate or even moniliform. Medulla in some species gradually transformed into the lower cortex, in others well marked off from it. Hyphae of the lower cortex more or less parallel to the surface. Gonidia — according to ZAHLBRUCKNER l. c. — *Protococcus*.

Apothecia middle-sized or small, gonidia crowded in the margin, less numerous under the hypothecium and (or) within the cortex of the receptacle. Paraphyses conglutinate, incrassate at the apices, septate, undivided

or (at least in all Norwegian species) occasionally furcate or branched. Asci octosporous, membrane incrassate at the apex. Spores brown or greyish brown, one-septate, ellipsoidal or somewhat fabiform, constricted or not at the septum, smaller than in *Anaptychia*.

Perifulcrum dark at the ostiolum, otherwise uncoloured or — in age — darkened, fulcra endobasidial, pycnoconidia short, straight, cylindrical or ellipsoidal.

Chemical reaction. No colouring by CaCl_2O_2 . Reaction with KOH important, characteristic of the species. Hymenium in some (few) species persistently blue with J, but usually first blue, then sordid vinous red, or dark red to black.

Clavis specierum.

1. Cortex coloured yellow by KOH.
 2. Medulla coloured yellow by KOH.
 3. Thallus sorediate.
 4. Thallus brownish or greyish-brown.
 18. *Ph. intermedia*.
 - 4 * Thallus greyish or greyish white.
 5. Laciniae elongate, very narrow (0,2—0,3 mm. broad), lower side uncoloured.
 17. *Ph. teretiuscula*.
 - 5 * Laciniae shorter and broader (0,5—1 mm.), lower side black.
 16. *Ph. caesia*.
 - 3 * Thallus not sorediate.
 4. Thallus saxicolous, colour ash-grey.
 19. *Ph. melops*.
 - 4 * Thallus corticolous, colour white or greyish-white.
 2. *Ph. aipolia*.
 - 2 * Medulla not coloured by KOH.
 3. Laciniae appressed, not sorediate.
 4. Laciniae with spreading, marginal cilia.
 4. *Ph. tenella* var. *leptalea*.
 - 4 * Laciniae without marginal cilia.
 1. *Ph. stellaris*.
 - 3 * Laciniae more or less ascending, sorediate at the apices.
 4. Laciniae elongate, narrow, with numerous spreading marginal cilia.
 5. Laciniae with fornicate apices.
 3. *Ph. ascendens*.
 - 5 * Apices not fornicate.
 4. *Ph. tenella*.
 - 4 * Laciniae short, broad, without or only with a few marginal cilia.
 5. *Ph. tribacia*.
 - 1 * Cortex not coloured by KOH.
 2. Thallus more or less pruinose.
 3. Thallus sorediate.
 9. *Ph. grisea*.
 - 3 * Thallus not sorediate.

- 4. Laciniae appressed.
 - 6. *Ph. pulverulenta*.
- 4* Laciniae more or less ascending.
 - 5. Laciniae coarse, chestnut-brown, very pruinose.
 - 7. *Ph. muscigena*.
 - 5* Laciniae thin, greyish-brown, almost epruinose.
 - 8. *Ph. constipata*.
- 2* Thallus epruinose.
 - 3. Laciniae narrowly filiform.
 - 13. *Ph. tremuticola*.
 - 3* Laciniae narrow or broad, but never filiform.
 - 4. Lower part of the medulla red.
 - 14. *Ph. endococcina*.
 - 4* Medulla uniformly uncoloured.
 - 5. Neither soredia nor isidia developed.
 - 6. Corticolous.
 - 10. *Ph. obscura*.
 - 6* Saxicolous.
 - 12. *Ph. lithotea*,
ff. nuda and lithotodes.
 - 5* Thallus either with soredia or isidia.
 - 6. No isidia, thallus sorediate.
 - 11. *Ph. virella*.
 - 6* No soredia, thallus isidiate.
 - 7. Lower side uncoloured.
 - 15. *Ph. sciastrella*.
 - 7* Lower side black.
 - 12. *Ph. lithothea*.

1. *Physcia stellaris* (L.) NYL.

Lichen stellaris LINNÉ Spec. plant. (1753) p. 1144 pp.; HOFFM. Enum. (1784) p. 71 et tab. XIII fig. 1—2.

Parmelia stellaris ACHARIUS Methodus (1803) p. 209; ACHARIUS Lich. Univ. (1810) p. 476; KOERBER Systema (1855) p. 85 (sensu latiore).

Physcia stellaris (L.) NYL. var. *adpressa* TH. FR. Lich. Scand. I (1871) p. 138; LYNGE Busk og bladlaver (1910) p. 102.

Physcia stellaris NYLANDER Prodrumus (1857) p. (307) (sensu latiore), NYLANDER Synopsis (1860) p. 424 (sensu latiore), Nylander Lich. Scand. (1861) p. III (sensu latiore), DEICHMANN BRANTH og ROSTRUP Lichenes Daniae (1869) p. 65, tab. III, fig. 13, MÜLLER u. PABST Flechten (1876) tab. V, (sensu latiore), NYLANDER Addenda nova Flora (1870) p. 38, Wainio Adjumenta I (1881) p. 134, CROMBIE Brit. Lich. I (1894) p. 310, HUE Lich. Extra-Eur. (1900) II, p. 58; OLIVIER Lich. d'Eur. I (1907) p. 239; HARMAND Lich. France (1909) p. 617.

The starting point for the combination *Physchia stellaris* (L.) NYL. in this limitation is NYL. Addenda nova, — not Prodromus, — because in the latter work *P. stellaris* comprises our *stellaris*, *aipolia* a. o. species.

Exsicc. ARNOLD Lich. Exsicc. 788 a-d., CLAUD. et HARM. Lich. Gall. praec. 179, Flora Exsicc. Austr. Hung. 2732 I-II, FRIES Lich. Suec. 206 A, HEPP Flechten Eur. 878, MERRILL Lich. Exsic. 228, MIGULA Krypt. 45, RCHB. et SCHUB. 86, STENH. Lich. Suec. 73 (supr.), TUCKERMAN Lich. Amer. 83. ZAHLBRUCKNER Krypt. Exsicc. Vindob. 1260,

Thallus orbicular, small or medium-sized, 2—4, rarely 6—7 cm. in diam., appressed to the substratum through numerous, white or greyish, branched rhizinae. Laciniae at least at the circumference stellate, narrow, 0.5—0.7, rarely 1 or even 2 mm. broad, sometimes widened at their apices, but quite as frequently narrowed or even pointed. They are short, multifid, most frequently divaricately furcate with short interstices and therefore discrete; sometimes they are pinnate and more contiguous. Laciniae with crenate or crenato-incise apices, entire or slightly undulated contours, and more or less unto very convex surface, smooth towards the circumference, and rugose or even bullate towards the centre, at least in coarse specimens. Secondary laciniae are found, but they are not numerous. Laciniae epruinose or rarely slightly pruinose at their apices, thallus without soredia or isidia, opaque or with a faint horny splendour. Colour uniform, white or greyish white, moistened unaltered or with a tinge of green. Lower side white.

Upper cortex 20—40 μ thick. An exterior equally thick part (18—25 μ) is opaque with indistinct hyphae, an interior part of varying thickness uncoloured with distinct hyphae. Cortical hyphae perpendicular to the surface, sometimes almost plectenchymatous, constrictedly septate with rounded articuli. Gonidia arranged in an incoherent stratum of varying thickness. Its upper surface is more plane than in *Ph. aipolia*. Medulla uncoloured with very loosely interlaced hyphae, gradually transformed in the lower cortex. The hyphae of the lower cortex more closely interlaced, more thickwalled and more refractive, the majority of them more or less parallel to the surface. Rhizinae 80—100 (150) μ thick.

Apothecia numerous to very numerous, rounded or angular, due to mutual pressure. Disc plane, opaque, brown or brownish black, with or without pruina. Margin thick, persistent, entire or crenate, without folioli. Receptacle rugose, of the same colour as the thallus or yellowish about the centre. Its cortex from 80—140 or even 240 μ thick, in the exterior

part uncoloured or slightly shadowed with hyphae perpendicular to the surface, otherwise uncoloured with hyphae of different directions. Gonidia crowded in the margin, less numerous within the cortex, absent or very few under the hypothecium and in the medulla. Hypothecium uncoloured, 20—30 μ thick. Hymenium 80—100 (130) μ thick, epithecium yellowish-brown, insperse, occasionally with crystals of oxalate of lime, otherwise the hymenium is uncoloured and not insperse. Paraphyses slender, at their ends clavately incrassate (5 μ or less), indistinctly septate, undivided or usually more or less branched. Asci clavate, rather narrow, 67—85 μ long, 15—17 μ thick, octosporous. Spores straight, elliptic, or sometimes slightly flattened on one side, not constricted or only imperceptibly so at the septum, with rounded apices. Cell rooms approximate, angular, and stretched across the spore connected by a distinct canal. Spores shorter than in *Ph. aipolia*: 17,6—23,5 (25) μ long, 8—10,5 (11,8) μ thick.



Fig. 4. *Physcia stellaris* (L.) NYL.

Pycnides numerous (but frequently sterile), located in the ends of the laciniae (primary and secondary), and sometimes in the margin of the apothecia. They are globose or later depresso-globose, with a prominent ostium, 150—165 μ high and 150—240 μ broad. Perifulcrum black around the ostium, otherwise uncoloured or only locally shadowed. Pycnoconidia straight, cylindrical, 3—5 μ long. — In the thickened black part around the ostium is comprised the cortex as well as the perithecium.

Reaction: The cortex is coloured yellow by KOH, the medulla remains uncoloured, no colouring by CaCl_2O_2 . Hymenium blue, then dark vinous or black by J (only in very young undeveloped apothecia I have seen a persistent blue colour).

Physcia stellaris (L.) NYL. is much more monotypous than *Ph. aipolia* (ACH.) NYL. Its varieties *radiata* and *rosulata* are founded on individual variation more than on constant systematic differences, and probably on different states of age.

Owing to the slow growth of the Lichens the question of the alterations of their habitus with the age has been little studied. Evidently many adult plants preserve juvenile characters with great firmness. Some Lichens, e. g. *Ph. stellaris*, normally have branched paraphyses, but in the same specimen we can find apothecia with normal paraphyses, and others (well developed) where undivided paraphyses are the rule. This is also

the case with morphological characters, e. g. the branching of the laciniae which is of great importance for the whole habitus. ACHARIUS himself is of opinion that his f. *rosulata* is a »status adultus et senilis«. ¹

var. *radiata* (ACH.) NYL.

Parmelia stellaris α *radiata* ACHARIUS Lich. Univ. (1810) p. 477.

Physcia stellaris α *adpressa* a. *genuina* β . *radiata* TH. FRIES Lich. Scand. I (1871) p. 139.

Physcia stellaris f. *radiata* NYLANDER Lich. Scand. (1861) p. 111. HARMAND Lich. France (1909) p. 618.

Tab. III fig. 5.

var. *stellata* is a variety with narrow, stellate, from the centre to the circumference discrete and continuous laciniae. Apothecia with pruinose disc and entire margin.

var. *rosulata* (ACH.) NYL.

Parmelia stellaris β . *rosulata* ACHARIUS Lich. Univ. (1810) p. 477

Physcia stellaris α . *adpressa* a. *genuina* β . *rosulata* TH. FRIES Lich. Scand. I (1871) p. 139.

Physcia stellaris f. *rosulata* NYLANDER Lich. Scand. (1861) p. 111. HARMAND Lich. France (1909) p. 618.

Tab. III fig. 4.

var. *rosulata* is a coarser variety, with broader, rugose laciniae, which are contiguous at the centre and discrete only at the circumference. Apothecia with black, epruinose disc and crenate margin.

Intermediate varieties are frequent, especially one with the habitus of var. *radiata* and entire margin and epruinose disc. The saxicolous specimens belong here. However, we not rarely find the inverse proportion: pruinose disc and crenate margin. — f. *corallina* NORM. in herb. is p. p. *Ph. aipolia*, p. p. a coarse *Ph. stellaris* var. *rosulata* with microphylline, very bullate central laciniae. — In the island Tromsøen I have found a *Ph. stellaris* with very crenate laciniae, and coarsely crenate apothecia with brown epruinose disc.

¹ Lich. Univ. p. 477.

Hab. *Physcia stellaris* is found on the bark of deciduous trees, especially on *Populus tremula* and *Alnus incana*, also on *Fraxinus excelsior*, *Salices*, *Prunus spinosa* etc. I have not seen it on *Betula*. Also on rocks (chalk), and schistose rocks, very rarely on moss. — *Physcia stellaris* (i. e. var. *radiata* and var. *rosulata*) has the same distribution in this country as *Ph. aipolia*, but it much less abundant. — Its vertical distribution is less known. I have not seen it from stations higher than the tree-line, and it is not probable that it ascends higher. — The majority of our material belongs to var. *radiata*.

Loc. Frequent about Kristiania (M. N. BLYTT and others), and in Aker (LYNGE), Bærum (F. KLÆR), and Asker (LYNGE), also in the south-eastern lowlands: Drammen (KLÆR), Nordmarken, Minne, Helgøen (LYNGE), Ringebu (SOMMERFELT), Veldre (NORDHAGEN), Brandbu (LYNGE), Toten (SOMMERFELT), Kongsberg (POULSSON). Frequent in our great valleys: Østerdalen at Lille Elvedalen (LYNGE), Gudbrandsdalen at Lillehammer (JEBE), Vaagemo and Lom (LYNGE), Drivdalen (LYNGE), Numedal at Listad (F. KLÆR), in Telemarken near Rjukan (LYNGE). Probably frequent in Southern Norway: Lyngør, and Nergaren in Aamli (LYNGE). According to HAVAAS (in lit.) it is not unfrequent in Western Norway from the coast (Moster) to the inner end of the fjords. Voss (LYNGE), Trondhjem (KINDT), Frosta (JØRSTAD). Northern Norway: Saltdalen (SOMMERFELT), frequent along the coast of Tromsø amt: Gibostad, Ramfjorden, Maalsnes (LYNGE), and Tromsø (NORMAN), and very abundant in the extensive *Alnus*-formations in the valleys along the rivers: Maalselven, Bardo, Lyngen, Nordreisen (LYNGE). It is only recorded from the interior provinces of Finmarken: Luobal (NORMAN), and Skoganvarre (LYNGE) in Porsanger.

Recorded on rocks (only chalky) from Ibbested and Mestervik in Tromsø amt (LYNGE), and on moss from Trondenes in Tromsø amt (NORMAN).

f. *tenuisecta* TH. FR. in herb.

Thallus orbicular, minute, diam. 1.5—2 cm., laciniae very narrow, filiform, irregularly curved, stellate only at the circumference, intricately branched, imbricate, grey.

Recorded from Gudbrandsdalen: between Øien and Klevstad (TH. FRIES, herb. mus. Upsal.).

var. *tenera* (HAVAAS) LYNGE.

Physcia tenera HAVAAS Lich. Norv. exsic. 425.

Tab. III fig. 2.

Thallus small, orbicular, 2—3 cm. in diam. Laciniae closely appressed to the substratum, multifid, repeatedly divaricately furcate or pinnate, with acute angles, discrete, continuous from the centre to the circumference, linear, equally broad, very narrow: 0,3—0,5 mm. broad, with undulate contours. Thallus epruinose, without isidia or soredia, colour pale greyish-white, lower side uncoloured. Thallus resting on a cushion of well developed, branched rhizinae on the lower side and at the margin of the laciniae. Rhizinae grey or somewhat darker towards the centre. — Secondary laciniae not seen.

Thallus very thin (100 μ). Upper cortex 20—25 μ thick, its hyphae adspersed and very indistinct, discernable only in very thin sections, perpendicular to the surface, constrictedly septate with rounded articuli. Gonidia numerous, arranged in a thick stratum, filling up the greater part of the medulla. Medullary hyphae very loosely interlaced, no distinct limit between the medulla and the lower cortex. Hyphae of the lower cortex very thick-walled, densely interlaced, refractive, more or less parallel to the surface, uncoloured. Lower cortex 20—30 μ thick.

Apothecia numerous, orbicular, small, 1—1,5 mm. in diam., sessile, but not appressed, disc epruinose, margin persistent, very thin, minutely crenate. Spores rather small: 16,3—19,8 μ long, 7,9—9,2 μ thick. The texture of the apothecia otherwise entirely as in the species.

Reaction as in the species.

Hab. On the smooth bark of *Populus tremula*, far from the ground, in subalpine stations (300—350 m. s. m.).

Loc. Only recorded from Granvin in Hardanger, Western Norway (HAVAAS).

I am unable to regard this plant as a proper species. It grows associated with forms of *Ph. aipolia* which have also very narrow laciniae, (convergent forms). Its very local distribution indicates a modification of the habitat.

2. *Physcia aipolia* (ACH.) NYL.

Lichen aipolius ACHARIUS Prodrromus (1798) p. 112.

Parmelia aipolia ACHARIUS Methodus (1803) p. 209, ACHARIUS Lich.

Univ. (1810) p. 477, ACHARIUS Synopsis (1814) p. 215. SOMMERFELT Supplem. Fl. Lappon. (1826) p. 111.

Physcia stellaris FR. NYLANDER Synopsis (1860) p. 424.

Physcia stellaris var. *aipolia* NYLANDER Lich. Scand. (1861) p. 111.

Ph. stellaris α *adpressa* var. *aipolia* TH. FRIES Lich. Scand. I (1871) p. 139.

LYNGE Busk og bladlaver (1910) p. 103.

Physcia aipolia NYLANDER Addenda Nova Flora (1870) p. 38. WAINIO Adjumenta I (1881) p. 135. CROMBIE Brit. Lich. (1894) p. 313. HUE Lich. Extra-Eur. (1900) p. 60. DALLA TORRE et SARNTHEIM Die Flechten von Tirol (1902) p. 158. ELENKIN Lich. Ross. Med. (1907) tab. V, fig. 8. HARMAND Lich. France (1909) p. 619. SANDSTEDT Flechten d. n. w. deutschen Tieflandes (1913) p. 234.

DALLA TORRE and SARNTHEIM write (l. c.) »*Physcia aipolia* (EHRH.) NYL«, founded on EHRHART Pl. crypt. exsicc. 207 (1785). I have not the plant of EHRHART before me, and cannot decide whether it really is our species. Anyhow the combination of the said authors is incorrect, for EHRHART named his plant »*Lichen ambiguus*«, not »*Lichen aipolius*«. According to the Schedae of ZAHLBR. Krypt. Exsicc. no. 1980, the collection of EHRHART is not valid as a foundation for lichenological nomenclature.

Exsicc. ANZI Lich. Ital. sup. 117 (var. *acrita*, s. n. *Parmelia stellaris* var. *ambigua*). CLAUD. et HARM. Lich. Gall. praec. 127. CUMMINGS, WILLIAMS & SEYMOUR Lich. Bor. Amer. Ed. II, 168 (var. *acrita*, s. n. *Physcia stellaris* (L.) TUCK.). FLOERKE Deutsche Lichenen (var. *acrita*, s. n. *Parmelia aipolia* ACH.). HAVAAS Lich. Norv. 215 (var. *anthelina*). HEPP Flechten Eur. 877 (var. *acrita*). LEIGHTON Lich. Brit. 6 (var. *acrita*, s. n. *Parmelia stellaris* ACH.). MALBRANCHE Lich. Norm. 25 (var. *acrita* s. n. *Physcia stellaris*). MALME Lich. Suec. 205 (inter *anthelinam* et *acritam*). MASSALONGO Lich. Ital. 318 (A. var. *acrita* B. var. *anthelina*, s. n. *Squamaria aipolia* MASS.). MIGULA Krypt. 92 (var. *acrita*). SCHAEERER Lich. Helv. 350 (var. *acrita*). STENHAMMAR Lich. Suec. 73 inf. (var. *acrita*, s. n. *Parmelia stellaris* Fr.). ZAHLBRUCKNER Krypt. Exsicc. Vindob. 2078 (var. *acrita*).

Thallus middle-sized or large, orbicular, diam. up to 11—12 cm., rigid, closely appressed to the substratum and attached through branched rhizinae of dark or pale colour. Lacinae stellate, of varying length, 1—1.5 mm. broad, usually broader, up to 2—2.5 mm. at the ends, and rounded, crenate or incise. Lacinae either repeatedly furcate or pinnate, with many short lateral branches; in some varieties they are contiguous or even imbricate, in others discrete. They have an irregularly

undulate or crenato-incise outline, they are plane or in some varieties slightly convex, originally smooth or later on — specially about the centre — more or less rugose, and frequently instructed with numerous short, verrucose or papillose secondary laciniae. Thallus without pruina, isidia or soredia, but suffused with numerous small white dots. Colour white or greyish-white, moistened with a faint cast of green, but never apple-green as in *Ph. pulverulenta*.

Upper cortex in the exterior part pale greyish (8—16 μ), otherwise uncoloured. Hyphae plectenchymatous, rather thick-walled with spacious cell-rooms. Gonidia glomerate in a stratum with a very unequal upper surface, its distance from the surface of the thallus varying from 10—45 or even 55 μ . Medulla white, hyphae loosely woven, especially in the upper part, slightly adspersed, 2.5—4.5 μ thick. Lower cortex more or less well marked off from the medulla, 15—60 μ thick, either entirely uncoloured, or in the outer part darker coloured. The majority of the hyphae are more or less parallel to the surface. Sometimes the lower cortex is locally plectenchymatically developed. Rhizinae 50—90 μ thick.

Apothecia well developed, sometimes covering the central part of the thallus. They are rounded or angulose, due to mutual pressure. Margin thick, persistent, entire or crenate, but without folioli. Disc plane, opaque or slightly shining, colour reddish brown or black, without or in some varieties with a white pruina. Receptacle more or less rugose, of the same colour as the thallus or yellowish about the centre. Its cortex is very thick, up to 220 μ , uncoloured or faintly shadowed in the exterior part, built up of very refractive, 5—6 μ thick hyphae, which are perpendicular to the surface in the exterior part, and of a more irregular direction in the interior part. Gonidia crowded in and near the margin and arranged in a more or less continuous stratum under the hypothecium and within the cortex, but only scattered in the thin medulla. Hymenium in the outer part yellowish or reddish-brown, otherwise uncoloured, frequently with oildrops; 100—130 μ thick. Paraphyses 2—2.5 μ thick, slightly clavately incrassate towards the ends, in the thick part constricted, otherwise indistinctly septate, they are undivided or more or less branched. Asci clavate, 65—70 μ long, 14—20 μ thick, octosporous. Spores obliquely biserial or sometimes parallel to the asci, straight, ellipsoidic or slightly flattened on one side, not constricted, rounded at the ends. Cell-rooms connected through a distinct canal; they are small, either angulose and stretched across the spores or rounded (like a sand-glass); dimensions 20—26 (29) μ long, 8.5—11 (13) μ thick.

Pycnides numerous or very numerous, located in the ends of the laciniae, globose or depresso-globose diam. 200—240 μ . Perifulcrum black about the ostium, otherwise uncoloured, or only locally darkened. Basidia 5—6 μ long, 4—5 μ thick. Pycnoconidia straight, cylindrical or slightly incrassate at the septum, 4—5 (5.5) μ long, 1—1.5 μ thick.

React. Cortex as well as medulla distinctly yellow by KOH, no colour by CaCl_2O_2 . Hymenium first blue, then black or sordid vinous red by J.

The statements of the dimensions of the spores vary: CROMBIE 16—26 \times 8—11, HARMAND 24—28 \times 10—13, SANDSTEDE 16—24 \times 7—10, JATTA (Sylloge p. 140) 24—36 \times 6 μ , which is certainly incorrect.

Physcia aipolia is on a whole a larger plant than *Ph. stellaris*, and well separated from this species by the more elongate and plane laciniae, which are more closely appressed to the substratum, and especially by the KOH-reaction of the medulla. The spores are longer, but not thicker, than in *Ph. stellaris*; large *stellaris*-spores are so long as medium-sized *aipolia* spores.

Physcia conerustans NYL.¹ has a distinct positive KOH-reaction of the medulla, and cannot, accordingly, belong to the *Ph. obscura* tribe. It has a thick, very rugose thallus. Prof. ELFVING, Helsingfors, was kind enough to send me a specimen for comparison. I consider it to be merely a morbid *Ph. aipolia*.

The lichenologists have proposed numerous varieties of *Physcia aipolia*. It will be seen from the descriptions that they differ in characters, which are very variable in the genus. It is hardly possible to attribute a great systematic value to them, with the exception of the *angustata*, which can safely be raised to the rank of a subspecies, and perhaps to a proper species (petit espèce). ACHARIUS, the great founder of our science, arranges the varieties into a juvenile one (f. *acrita*) with a pale lower side, uncoloured rhizinae, and apothecia with entire margin, and into two adult ones: f. *cercidia* with black rhizinae and contiguous laciniae, and f. *anthelina* with pale lower side and discrete laciniae.

¹ Addenda nova p. 350.

var. *acrita* (ACH.) WAIN.

Incl. var. *cercidia* (ACH.).

Parmelia aipolia α *acrita* ACHARIUS Lich. Univ. (1810) p. 477. SOMMERFELT Suppl. Fl. Lapp. (1826) p. 111.

Physcia stellaris α *adpressa* β *aipolia* α *acrita* et β *cercidia* TH. FRIES Lich. Scand. I (1871) p. 139. *Ph. stellaris* var. *acrita* et var. *cercidia* NYLANDER Lich. Scand. (1861) p. 111.

Physcia aipolia var. *acrita* (vel *cercidia*) WAINIO Adjumenta I (1881) p. 136. CROMBIE Brit. Lich. I (1894) p. 314. HARMAND Lich. France (1909) p. 619.

This is a coarse plant of a habitus approaching to *Ph. pulverulenta* var. *allochroa*. The laciniae are contiguous, rather short and broad, and usually of a slightly darker colour than var. *anthelina*. At the circumference they are plane, in the centre with wrinkles lengthways of the laciniae, more or less rugose, and furnished with many small secondary laciniae. Lower side pale or dark.

The disc of the apothecia naked or pruinose, margin entire or crenate.

I can see merely a difference of age between var. *acrita* and var. *cercidia*; var. *cercidia* has a dark lower side and crenate apothecia. Crenate apothecia are decidedly a mark of age, and the colour of the lower side is a very variable character in the genus.

Hab. Found on the bark of deciduous trees, especially on *Populus tremula*. — It has not yet been reported from Finmarken, otherwise it has the same distribution as var. *anthelina*.

Loc. Very abundant about Kristiania and known from numerous stations in Aker, Bærum, and Asker (hb. M. N. BLYTT and others). Frequent in the southeastern lowland: Veldre (NORDHAGEN), Toten (SOMMERFELT), Norderhov (NORMAN), Brandbu, Minne, and Vestfjorddalen (LYNGE). Frequent in Southern, most probably also in Western Norway and in the Trondhjem district: Aas and Drøbak (LYNGE), Drammen (hb. M. N. LUND), Skien (HOCH), Lyngør (LYNGE), Voss (LYNGE), Granvin (HAVAAS), and Frosta (JØRSTAD).

Northern Norway: Salten (SOMFT.). Frequent in Tromsø amt in the valleys as well as along the coast on the bark of *Alnus* and *Populus*:

Maalsnes (LYNGE), Tromsøen (NORMAN), Likkavarre in Maalselven, Strømsmo in Bardo, and Lyngseidet (LYNGE). Not yet recorded from Finnmarken.

var. *anthelina* (ACH.) WAIN.

Parmelia aipolia var. *anthelina* ACHARIUS Lich. Univ. (1810) p. 478. SOMMERFELT Supplem. Fl. Lappon. (1826) p. 111.

Physcia stellaris var. *anthelina* NYLANDER Lich. Scand. (1861) p. 111.

Physcia stellaris α *adpressa* β *aipolia* γ *anthelina* TH. FRIES Lich. Scand. I (1871) p. 140.

Physcia aipolia f. *anthelina* WAINIO Adjumenta I (1881) p. 135. CROMBIE Brit. Lich. (1894) p. 313. HARMAND Lich. France (1909) p. 619.

Tab. III, fig. 3.

This is also a coarse variety with elongate, stellate, much branched and discrete laciniae, continuous from the centre to the circumference. Colour white or greyish-white. Laciniae slightly convex or pale, smooth or a little rugulose, with numerous papillose or branched secondary laciniae in the central parts. The long black tomentose rhizinae are distinctly seen between the discrete laciniae.

The disc of the apothecia is dark, brownish-black, covered by a dense white or bluish-white pruina. Margin usually entire, crenate only in old and coarse plants.

There are many transitional states between var. *acrita* and var. *anthelina* with broad, more or less contiguous laciniae.

Hab. var. *anthelina* prefers the bark of *Populus tremula* and is a faithful companion of that tree. It is also frequently found on the bark of other deciduous trees (not *Betula*). It is one of the most frequent Lichens in Norway and is distributed through the whole country from Lindesnes to the Russian frontier. It ascends to 900–1000 m. s. m. (as high as its hosts), but it is rare at that elevation.

Loc. Abundant about Kristiania from innumerable stations in Aker, Bærum, and Asker (N. G. MOE and others), and from the south-eastern lowlands and all the great valleys: Sundvolden (HAVAAS), Minne, Helgøen (LYNGE), Rena (F. KLÆR), Søndre Fron (F. KLÆR), Dovre (ZETTERSTEDT), Land and Vang (NORMAN), Kongsberg (POULSSON), Hol (LYNGE). Frequent along the south coast: Larvik (NORMAN), Lyngør (LYNGE), and in Western Norway from the coast to the limit of trees: Moster and Granvin (HAVAAS

and LYNGE), Voss (LID), Reime (LYNGE). From the Trondhjem district: Trondhjem (KINDT), Frosta (JØRSTAD).

In Northern Norway *Populus* is not frequent as a tree along the coast, but rather abundant in the valleys. Var. *anthelina* has the same distribution: Salten (SOMMERFELT), abundant in Maalselven and Bardo: Moen, Bjørnstad, Rostavand, Strømsmo, Indset (LYNGE). In Finmarken only from the interior: Skoganvarre (LYNGE), Karasjok (NORMAN), Polmak (TH. FRIES), Sydvaranger (HAVAAS).

Var. *anthelina* is evidently a more northern plant than var. *acrita*. It is the more frequent in Northern Norway, whereas the greater part of our Extra-Norwegian material belongs to var. *acrita*.

var. *alnophila* WAIN.

Physcia aipolia f. *alnophila* WAIN. Adjumenta I (1881) p. 136.

Tab. III, fig. 1.

Var. *alnophila* is a more tender plant with the habitat of *Physcia stellaris*. The laciniae are short, narrow, contiguous, discrete only at the circumference, somewhat convex; they are much — dichotomously — branched and therefore less distinctly stellate. The white dots are only slightly conspicuous. Colour white or greyish-white. Lower side clothed with black rhizinae.

Apothecia very numerous, sometimes covering the central parts of the thallus. Disc epruinose, margin entire or (f. *crenulata* WAIN.)¹ crenate.

It may be mistaken for a coarse *Ph. stellaris*, but is with certainty distinguished from this species by the medullary reaction (KOH⁺). In my opinion there is merely a difference of age between var. *alnophila* and var. *crenulata*.

Hab. var. *alnophila* prefers the bark of *Alnus incana*, but is also found on other deciduous trees (not *Betula*), especially on *Salix*; very rarely on stone. It is markedly a northern plant, and is only rarely found south of Dovre.

Loc. In Southern Norway: Bergen (hb. FRIELE), Kongsvold (saxicola, hb. F. KLÆR). North of Dovre: Trondhjem: Sorgenfri (LYNGE), Steigen

¹ Adjumenta I p. 136.

(NORMAN), Ibbestad (LYNGE). It is found on nearly every tree of *Alnus incana* in the extensive plantations of that tree in Maalselven and Bardo along the rivers (LYNGE). Finmarken: Kautokeino (WAHLENBERG), and Raipas in Alten (ZETTERSTEDT).

var. *subincisa* (TH. FR.) LYNGE comb. nov.

Parmelia incisa FR. STENHAMMAR. Iagttagelser rörande Lafvarnes historia och utbredning. Förhandl. vid Skand. Naturf. möte III (1842) p. 614.

Physcia stellaris α *adpressa* β. *aipolia* δ *subincisa* TH. FRIES Lich. Scand. I (1871) p. 140 (ubi syn.).

According to NYLANDER¹ FRIES Lich. Suec. 340 belongs to var. *subincisa*.

It approaches var. *alnophila* on account of its short laciniae. It is separated from var. *alnophila* by still shorter, very rugose, closely contiguous or even imbricate laciniae and an almost crustaceous (placodiiform) habitus. Central laciniae very convex, bullate or papillose. Colour white, lower side also white or pale yellowish-grey, rhizinae of the same colour.

The specimens are quite fertile, the apothecia are crowded with entire, or at last slightly crenate margin, and pruinose disc.

Western Norway: Vindellen in Lerdal, at the inner end of the Sognefjord, on stone (SOMMERFELT) s. n. *Parmelia stellaris* ACH. It must be rare in Norway, for it has not been detected elsewhere.

TH. FRIES saw the plants of SOMMERFELT and identified them with the authentic specimens of STENHAMMAR. — Var. *subincisa* has a distinct positive medullary reaction and belongs to *Ph. aipolia*, not to *Ph. stellaris*, as already stated by TH. FRIES.

STENHAMMAR's name is a »nomen nudum«, without description.

subsp. *angustata* (NYL.) WAIN.

Physcia stellaris var. *angustata* NYLANDER Synopsis (1860) p. 426.

Ph. stellaris var. *aipolia* f. *angustata* NYLANDER Lich. Scand. (1861) p. 111.

Physcia aipolia f. *angustata* WAINIO Adjumenta I (1881) p. 136.

Var. *angustata* is a delicate plant with linear, very narrow (0,3—0,4 mm.) plane, discrete laciniae and small spores.

¹ Lich. Scand. p. 112.

There are two formae in Norway:

1) Probably the type of NYLANDER. Laciniae closely appressed to the substratum, very multifid with short interstices and divergent branches, branches fitting into one another like mosaic, more rarely stellate. Their outline is crenate. Lower side and rhizinae pale (in our plants).

Apothecia very numerous, small (diam. up to 1 mm.), margin entire, thin, disc epruinose. Spores small: 15,6—21 μ long, 7,6—8,7 μ thick.

Known from Finmarken: In the Tana valley at Storfossen, Seilnes, and Bassevuovde (NORMAN), in Alten at Reipas (ZETTERSTEDT); from Tromsø amt: Indset in Bardo (LYNGE).

2) f. *pruinosa* LYNGE n. f. Laciniae adpressae, parcius ramosae, interstitia ramorum longiores, angula axillarum acutior et eam ob causam thallus habitum plus stellatum habet; laciniae margine minute crenulatae. Thallus subtus albidus, rhizinae subconcolores vel dilute fuscescentes.

Apothecia majora (diam. usque 2,5 mm.), margine crasso integro circumdata, discus planus, intense caesio-pruinosis. Sporae parvae: 17—21 (23) μ longae, 7,9—10,5 μ crassae. — Pycnides desunt.

Salicicola, in insulam Tromsø (NORMAN).

NYLANDER's var. *angustata* is »fusconigro-fibrillosus«. The rhizinae of the Norwegian plants are either quite uncoloured or pale brown. I do not attribute much importance to this difference.

I have not been able to see an authentic specimen, and the description, given by NYLANDER in his wonted lapidary style, is insufficient for a certain determination. It is impossible to refer the Norwegian plants to any other variety of *Ph. aipolia*, and if they should be different from NYLANDER's var. *angustata*, they must be given a new name. In that case I should propose the name »*Physcia aipolia* var. *nordlandica* LYNGE.

3. *Physcia ascendens* BITTER.

Borrera tenella α ACHARIUS Lich. Univ. (1810), p. 498, ubi syn.

Physcia stellaris β *adscendens* (FR.) TH. FR. α *tenella* (WEB.) TH. FR. Lich. Scand. I (1870) p. 140.

An syn.: *Physcia stellaris* var. *tubulosa* WALLR. in WAIN. Lich. Vib. (1878) p. 50. «Laciniis adscendentibus, apice inflato, tubulatis et ibidem intus sorediosis.»

Physcia leptalea var. *tenella* (p. p.) HARMAND Lich. France (1909) p. 621.

Physcia ascendens BITTER Ueber die Variabilität einiger Laubflechten etc. (1901) p. 431 et 433 fig. 3 AB BOULY de LESDAINS Recherches sur les Lichens des Environs de Dunkerque (1910) p. 107 (sensu latiore).

The synonymy of *Physcia ascendens* and *Ph. tenella* is very intricate and has been still more complicated on account of the divergent opinion of the lichenologists as to their specific difference. It is therefore impossible to give a full list of synonyms without a study of the various authors' material. They were first separated as two species by BITTER (l. c.), but many eminent lichenologists (e. g. HARMAND) consider them to be merely individual variations produced by different degrees of humidity and temperature.

I have carefully studied the question in nature and on a large herbarium material, with the result that I agree with BITTER. The two species frequently grow together on the same tree, they are even entangled, the laciniae of one of them making their way between the laciniae of the other species. But a cautious examination will always enable us to separate them, and I have never seen their characters combined in one specimen. In addition to the morphological characters we may mention that *Ph. tenella* is frequently fertile, *Ph. ascendens* usually sterile. They have not the same distribution: *Ph. tenella* is recorded as far north as Tromsø, *Ph. ascendens* only to Trondhjem, *Ph. ascendens* is a lowland plant, *Ph. tenella* a coast lowland plant. In Norway *Ph. tenella* is much more frequent than *Ph. ascendens*.

Exsicc. ANZI Lich. Ital. super. 119 (*Parmelia stellaris* L var. *tenella* (SCOP.)), FRIES Lich. Suec. 206 B (*P. stellaris*), HEPP Flecht. Eur. 879 (*Lobaria tenella* (SCOP.) HEPP.), LEIGHTON Lich. Brit. 174 (*Borreria tenella* ACH.), MALBRANCHE Lich. NORM. 71 (*Ph. stellaris* var. *leptalea* NYL.). MALME Lich. Suec. 157 (*Physcia tenella*), MERRILL Lich. Exsic. 112 (*Physcia tenella* (SCOP.) NYL.), SCHAEER. Lich. Helv. 352 (*Parmelia stellaris* ♂ *tenella* SCHAEER.) et 607 dext. (coll. nob. s. n. *Parm. obscura* § *virella* SCHAEER.), TUCK. Lich. Amer. sept. 84 (*Parmelia stellaris* β *hispida* FR.). ZAHLBR. Krypt. Exsic. Vindob. 248 (s. n. *Physcia tenella*). (SCOP.) NYL., 880.

Thallus growing in small or middle-sized rosettes, diam. 2—3, rarely 5—8 cm. Laciniae at their ends free from the substratum and more or less ascending; they are rather compact, imbricate, short, 0,5—1 mm. broad, widened at the apices, convex or semi-cylindrical, bi- or tri-furcate,

entire or almost entire at the margin. Isidia absent. Some laciniae sorediate, soredia produced on the lower side of small, very convex or even helmet-like (fornicate), rugose, frequently perforate terminal laciniae. Other laciniae are esorediate; they are usually only slightly ascending, flatter and not fornicate, with truncate or rounded or frequently crenate or incise apices. Along the margin of the laciniae are found unbranched, long cilia, at their base of the same colour as the thallus, at their apices darker. The colour of the thallus white or whitish-grey, lower side uncoloured. When moistened, the »helmets« are somewhat translucent.

Upper cortex (25—) 30—40 (—60) μ thick, at the exterior part (13—18 μ) of a dark colour, otherwise uncoloured, formed of plectenchymatous, relatively thick-walled, constrictedly septate hyphae. Gonidia (diam. 9,5—11 μ) arranged in a broad undulate stratum under the cortex, they do not — or only exceptionally — grow out into the cortex. Medulla white, formed of branched, loosely interlaced hyphae, and gradually transformed into the lower cortex. Lower cortex not plectenchymatous, hyphae chiefly parallel to the surface. Thickness 25—45 μ .

Thallus usually sterile, but in fertile specimens apothecia are often abundantly developed. They are small, orbicular, diam. up to 2 mm., sessile, rarely very shortly pedicellate. Margin inappendiculate, minutely crenate, persistent, thin in old apothecia. Receptacle of the same colour as the thallus, rugose or smooth, without rhizinae, its cortex thick, up to 160 μ , formed by thick-walled, closely contiguous hyphae, perpendicular to the surface at the exterior part, but of indeterminate direction at the interior part. Gonidia numerous in the margin, few or absent under the hypothecium. Disc plane, frequently whitish pruinose, colour reddish-brown (at least when wet) or black. Hypothecium pale yellowish, 40—50 μ thick. Hymenium 80—90 μ thick, insperse and dark brown at the exterior part, otherwise uncoloured and not insperse. Paraphyses imbedded in a firm gelatina, rather thick (1,5—2 μ), at their apices clavately incrassate and distinctly constrictedly septate, most frequently unbranched, occasionally with short lateral branches. Asci clavate, 50—55 μ long, 20—22 μ thick. Spores obliquely biseriate, straight or slightly fabiform, ellipsoidal with distant focuses, only imperceptibly constricted at the septum. Cell-wall thick, cell-rooms small, usually in the shape of two cones with concurrent apices, occasionally irregularly angular. Asci normally octosporous, spores 17—22 μ long, 8—9,5 μ thick. Tetrastorous asci are very rare, with long spores: 24—27 μ long, 8—11 μ thick.

Pycnides are not rare, but fertile ones were searched for in vain.

Reaction: Cortex slightly yellow by KOH, medulla uncoloured, no colouring by CaCl_2O_2 . Hymenium persistently blue or bluish-black by J.

Hab. On the bark of deciduous trees, especially in avenues and trees in open situations, very rarely on rocks (moist Atlantic climate in Western Norway). It has a great predilection for the thin twigs of *Prunus spinosa*, wild *Ribes rubrum* and the like along the coast.



Fig. 5. *Physcia ascendens* Bitter.

Loc. *Physcia ascendens* belongs to the southern lowlands and is not recorded north of Trondhjem. It is frequent about Kristiania: Tøien, Hovedøen, Ekeberg (MOE), Høvik, Blommenholm (KLÆR), Skogumsaasen (LYNGE), also in the south-eastern lowlands: Nitedal (MOE), Høland (LYNGE), Sundvolden (HAVAAS and LYNGE), Minne, Hersjøen, Brandbu (LYNGE), Veldre (NORDHAGEN). Not (yet) recorded from our great south-eastern valleys. Frequent along the south and west coast: Haaøen (BLYTT), Hvaler (LYNGE), Larvik (BLYTT), Moster (HAVAAS and LYNGE, at Moster also saxicolous), less frequent towards the inland end of the western fjords (HAVAAS in lit.); Voss (HAVAAS). Trondhjem: Ladehammern (KINDT). Not recorded north of Trondhjem.

4. *Physcia tenella* (SCOP.) emend. BITTER.

Lichen tenellus SCOPOLI Flora Carniolica ed. 2 a (1772) p. 394.

Physcia tenella BITTER Ueber die Variabilität einiger Laubflechten (1901) p. 431 et 432 fig. 2.

The synonymy of this species is very intricate and the priority cannot be decided without a study of the authentic specimens of early authors. I have not seen the *Physcia tenella* of SCOPOLI. In naming the species BITTER does not argue from a point of priority, but from morphological views (»Durch die genannten Eigenschaften ist der Artname der beiden Lichenen begründet«). A full list of uncertain synonyms will make bad worse.

Exsic. CLAUD. et HARM. Lich. Gall. praecip. 128, FLOERKE Deutsche Lich. 73, FLOTOW Lich. Exsic. 90 B and 90 Bb (at least in our herb., s. n. *Parmelia stellaris fornicata* WALLR.), HAVAAS Lich. Norv. 336 (near *Ph. leptalea*), NORRL. et NYL. Herb. Lich. Fenn. 216 (*Physcia stellaris* * *tenella* f. *subbreviata* NYL. in lit.), RCHB. et SCHUB. 37, STENHAMMAR Lich. Suec. 212 inf. (*Parmelia caesia*).

Thallus growing in small rosettes, diam. up to 4 cm., rosettes often confluent, covering larger areas. Laciniae at the circumference slightly appressed, otherwise more or less ascending or protruding, short, narrow (narrower and more diffuse than in *Ph. ascendens*), flat or somewhat convex, multifid, repeatedly furcate, incise or lacerate. Thallus without isidia. Laciniae at their apices incurved or even revolute and on the (morphological) lower side densely sorediate. Laciniae along the margin clothed with long unbranched or branched cilia of the same colour as the thallus, or slightly darkened at their apices. Thallus of a white or greyish-white colour, moistened greenish, lower side white or greyish, surface opaque or rarely with a faint lustre; thallus not translucent.

Upper cortex 25–30 (–40) μ thick, uncoloured, or especially at the exterior part, greyish. Hyphae indistinct, 5–6 μ thick, perpendicular to the surface, thin-walled, constrictedly septate. Surface sometimes papillaceous from hyphae which grow forth. Gonidia crowded, diam. 12–14 μ . Medulla white. Lower cortex uncoloured, 25–50 μ thick, hyphae chiefly parallel to the surface.

Thallus frequently fertile; apothecia orbicular, diam. 1.5 to 2 mm., sessile or very shortly pedicellate. Margin thin, minutely crenate, but inappendiculate, frequently sorediate. Receptacle of the same colour as the thallus, rugose, without rhizinae. Cortex to 100 μ thick, hyphae septate, closely contiguous, perpendicular to the surface. Gonidia crowded in thick clusters within the cortex, few in the medulla and absent under the hypothecium, large, diam. up to 22 μ . Disc of young apothecia reddish-brown, then black, moistened persistently reddish-brown, epruinose or occasionally with a thin bluish pruina. Hypothecium up to 40 μ thick, uncoloured or yellowish. Hymenium 65–80 μ thick, with brown epithecium, otherwise it is uncoloured. Paraphyses rather thick (2 μ), at their apices clavately incrassate (3–4 μ) and constrictedly septate, usually unbranched, occasionally branched towards the tips. Asci narrowly clavate, 50–53 μ long, 14–18 μ thick, octosporous. Spores obliquely biserial, two-celled (or very rarely four-celled), ellipsoidal, straight, rounded at the ends, slightly constricted at the septum. Cell rooms small, rounded or angular. Colour pale greyish brown, size varying only slightly: 14–18.5 μ long, 7.4–10 μ thick.

Pycnides numerous, with protruding apices, oblong, 150–185 μ high, 120–130 μ broad. Perifulcrum dark at the ostiolum, otherwise uncoloured. Pycnoconidia straight, cylindrical, or slightly thickened at the middle, 3–4 μ long. — The pycnides are very frequently sterile.

React. Cortex faint yellow by KOH, medulla unaltered, no colouring with CaCl_2O_2 . Hymenium intensely and persistently blue with J.

Hab. On the trunks of deciduous trees, especially in open situations (avenues &c). One of the few *Physciae* which is frequently found on *Betula*. Also found on old wood (fences &c), and (rarely) on stone.

Loc. *Physcia tenella* is a lowland species, but not confined to the southern lowlands. It has been recorded as far north as Alten and Tromsø (miserable specimens), and in luxuriant specimens as far north as Bodø. It has not been recorded from the more continental districts of our country (the south-eastern valleys, in the s. e. lowlands only from Minne near the great lake Mjøsen. It is therefore evidently a coast species. — Many phanerogamous plants also have the northern limit of their continuous distribution about Lofoten, e. g. *Anemone Hepatica*, *Narthecium ossifragum* and *Blechnum Spicant*.

Physcia tenella is very frequent or even abundant about Kristiania: Tøien, Nitedalen (MOE), Hakedalen, Bryn, Bærum, and (the lower parts of) Nordmarken (LYNGE). Minne (LYNGE). Frequent along the south and west coast and fjords: Hvaler, and Sandeffjord (LYNGE), Larvik (NORMAN), Lyngør (LYNGE), Moster (HAVAAS and LYNGE), Fane at Stend (HAVAAS), Strandebrarm (LILLEFOSSE), Granvin: Havaas (HAVAAS and LYNGE), also at Voss (HAVAAS). Abundant about Trondhjem: Stjørdalen (SOMMERFELT), Ladehammern and Iisviken (KINDT), Sorgenfri (LYNGE), Frostø (JØRSTAD), Namsos (MALMGREN). Nordland: Bodø (SOMMERFELT). I have searched for it in vain in Tromsø amt, but there is a specimen from Tromsø in our herbarium (NORMAN). Finmarken: Bjørnstad in Alten (hb. NORMAN).

var. *marina* (E. NYL.) LYNGE comb. nova.

Lichen tenellus β WAHLENBERG Flora Lapponica (1812) p. 435 (I have seen his specimens from »petris denudatis prope littora maris«, but not from »parietibus ligneis«).

Physcia stellaris var. *marina* E. NYLANDER Ålands Laf-vegetation (1857) p. 86.

Physcia stellaris var. *subobscura* NYLANDER Ad vegetationem Helsing., Savol. et Alandiae addenda (1858—1859) p. 239. NYLANDER Lich. Scand. (1861) p. III. NYLANDER Synopsis (1858—1860) p. 426. CROMBIE Brit. Lich. I (1894) p. 311. KNOWLES The Marit. and Marine Lichens of Howth (1913) p. 125.

Physcia caesia * *leptalea* TH. FRIES Lich. Arct. (1860) p. 65.

Physcia stellaris β *adscendens* δ *marina* TH. FRIES. Lich. Scand. I (1871) p. 140.

Physcia leptalea var. *subobscura* OLIVIER Lichens d'Europe I (1907) p. 240 (164).

NYLANDER was well aware that this plant was named by EDW. NYLANDER, but he rejected the older name on the insufficient grounds that it was »non bonum»: *Dicta* var. *marina* l. c. sed hoc nomen non bonum, quia etiam aliae formae in maritimis occurrunt¹.

E. FRIES mentions a maritime form which is probably our species, but I have not seen his plants: »vidi rarissime v. c. e. Christiania in Norvegiae maritimis lectae cinereo-fuscescentem»².

TH. FRIES cites as a synonym *Borreria tenella* β *leptalea* ACH. Lich. Univ. p. 498³, the variety of Acharius perhaps includes our species, but it is not identical, which is seen from his description as well as from the station: »Habitat in saxis et truncis arborum Europae».

Exsic. STENHAMMAR Lich. Suec. 212 inf. dext.

Thallus loosely fixed to the substratum, pulvinate, laciniae at the circumference free from the substratum, but not ascendant or only slightly so, towards the centre more or less ascendant or even erect, subimbricate, repeatedly very multifid with divaricate, divergent interlaced branches. Laciniae elongate, narrow (0,2—0,5 mm. broad), convex, slightly rugulose, opaque, not isidiate, along the margin instructed with long, spreading unbranched dark cilia. The dilated, frequently incurved, never fornicate, apices of the laciniae soresidiate at their lower side. Colour ash-grey, varying from pale grey to very dark, almost black, lower side pale grey or uncoloured, with few rhizinae.

Hyphae of the upper cortex more thick-walled than in *Ph. tenella*. Apothecia and pycnides frequent; disc black.

Otherwise the anatomical, carpological and chemical characters as in *Ph. tenella*.

Hab. Confined to maritime rocks, growing along cracks or in low moist grooves, frequently sprinkled by the sea-water; the *Placodium*-belt of WARMING⁴.

¹ NYLANDER Ad vegetationem etc. l. c.

² E. FRIES Lich. Eur. reform. p. 83.

³ TH. FR. Lich. Arct. p. 65.

⁴ Dansk Plantevækst I Strandvegetationen p. 8.

Loc. It has a continuous distribution along our coast from the Swedish frontier in south to the Russian frontier in north, evidently frequent everywhere along the sea, but not recorded from the fjords. South and west coast: Vasser: Sandøen (LYNGE), Staværn (NORMAN), Lyngør (LYNGE), Moster (HAVAAS and LYNGE), Sunde near Luksund, Lyngrefjorden, and Stat (HAVAAS). Northern Norway: Rødø (NORMAN), Salten (SOMMERFELT), Tromsø (NORMAN), Nordfuglø (BLYTT), Alten (WAHLENBERG), Øxfjord (BAUR), Honningsvaag (LYNGE), Nordkap (WAHLENBERG), Vardø (HAVAAS), Næsseby and Sjaaholmen (TH. FRIES), (LAUDER LINDSAY records the *subobscura* NYL. from Dovre² (=Jerkin, corticolous and muscicolous^{*}). It is not probable that this could be correct.

Differs from the species in having darker thallus and cilia, more densely interlaced laciniae, and a more compact, pulvinate thallus. — Old herbarium specimens sometimes fade to a greyish-white colour. — It has a wider distribution than the type, which is frequently the case with maritime plants e. g. *Anaptychia ciliaris* var. *melanosticta*.

var. *leptalea* (ACH.).

Parmelia leptalea ACHARIUS Methodus (1903) p. 198.

Borrera tenella β *leptalea* ACHARIUS Lichenographia universalis (1810) p. 498.

Physcia stellaris var. 1 *leptalea* NYLANDER Synopsis (1860) p. 425. CROMBIE British Lichens I (1894) p. 311.

EXSIC. ANZI Lich. Ital. Sup. 118 A. (*Parmelia stellaris* var. *leptalea*; coarser laciniae than in our plants). NYLANDER cites TUCKERMAN Lich. Amer. sept. 84, in our copy no. 84 is *Ph. ascendens* BITTER).

Thallus small (up to 2 cm.), delicate. Laciniae appressed, discrete, multifid, pinnate or furcate with acute angles and divergent branches, very narrow (0.2–0.3, rarely 0.5 mm. broad), elongate with crenate, ciliate margins, cilia uncoloured at the base, darkened towards the apices. Thallus even or rugose, without soredia or with some small and inconspicuous apical soredia. Colour white or whitish-grey, under side of the same colour.

Apothecia with persistent, entire or minutely crenate margin, and epruinose or pruinose disc. Gonidia crowded in the margin, numerous in the medulla, also under the hypothecium; epithecium very insperse (in the

¹ Journ. Linn. Soc. Bot. vol. IX (1867) p. 379.

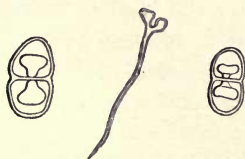


Fig. 6. *Physcia tenella*
var. *leptalea* (Ach.).

specimen examined) containing crystals of oxalate of lime. Paraphyses capitato-incrassate, frequently branched towards the apices. Spores straight or fabiform, only imperceptibly constricted at the septum, a little longer than in the type: $14.5-22.4 \mu$ long, $6.5-10.5 \mu$ thick. Reaction as in the type.

Hab. On the bark of deciduous trees, especially on *Populus tremula* and *Sorbus Aucuparia*.

Loc. Evidently a southern plant, rare and dispersed in Norway, perhaps more frequent in Western than in Eastern Norway: Hol in Hallingdal (LYNGE), Sogndalsstranden (HAVAAS), Moster and Granvin (HAVAAS and LYNGE).

I have never seen the *Parmelia leptalea* of ACHARIUS, but it evidently represents a plant with adpressed laciniae provided with long, marginal, spreading cilia. In »Methodus« the *leptalea* is separated from the *tenella* by the laciniae which in the former are »apice numquam fornicato-tubulosae«. In Lich Univ. the laciniae are described as »primo adpressae«. ACHARIUS cites »JACQ. Coll. 4, Tab. 6, f. a. b. c.« as a synonym, which delineates an adpressed plant, the laciniae, are, however, broader and coarser than in our plants.

The *tenella* of ACHARIUS is no doubt identical with the *ascendens* of BITTER: »lacinii apice adscendentibus tubuloso-fornicatis.« (Methodus p. 250), as is also the *Lichen hispidus* of WULFEN (JACQ. Coll. IV tab. VI, fig. d, excellent figure). WULFEN considers the erect or ascendent laciniae as stages of age, the laciniae are »in orbem quidem undique procumbentes, . . . cum tempore etiam cucullato-semitubulosi . . . vagisque libere ascendentibus & erectis.« (l. c. p. 248). WULFEN cites *Lichen tenellus* Scop. Flora Carniolica as a synonym of his *Lichen hispidus*. If this is correct, *Lichen tenellus* Scop. must be a collective name, not identical with *Physcia tenella* (Scop.) BITTER.

In Synopsis p. 425 NYLANDER has var. 1 (of *Physcia stellaris*) *leptalea* (Ach. Meth. p. 198) with »lacinii discretis, adpressis, margine fibrilloso-ciliatis«, and var. 2 *tenella* NYL. (syn. *Lichen tenellus* Scop. Carn. p. 1406): »subsimilis *leptaleae* minori, at fere effusa, lacinii adscendentibus apice saepe fornicatis«. NYLANDER's *tenella* is evidently the same as BITTER's *Ph. tenella* + *Ph. ascendens*.

Our (few) Norwegian specimens of var. *leptalea* agree with Dalmatian plants, labelled »*Physcia leptalea* NYL.» by ZAHLBRUCKNER, only that they are more delicate.

I am not convinced of the correctness of the synonyms of BITTER, but I cannot decide the question, not having seen the plants of ACHARIUS and SCOPOLI. I have, however, used BITTER's names, for the reason that I agree with him in his view of the species and because the meaning of his names is clear.

5° *Physcia tribacia* (ACH.?).

an syn. *Lecanora tribacia* ACHARIUS Lichenographia Universalis (1810) p. 415. ACHARIUS Synopsis (1814) p. 191.

Parmelia tribacia SOMMERFELT Supplementum Florae Lappon. (1826) p. 109.

Parmelia pulverulenta var. *dimidiata* ARNOLD Die Lich. des fränk. Jura. Flora (1864) p. 594.

Physcia albinea var. *dimidiata* NYLANDER Observata lichenologica in Pyrenaeis orientalibus. Flora (1872) p. 426.

Physcia (stellaris) trib(r)acia TH. FRIES Lich. Scand. I (1871) p. 140 (? Thallus KOH⁺). WAINIO Adjumenta I (1881) p. 135. WAINIO Lichenes in viciniis . . . Pitlekai. Arkiv för Botanik vol. VIII No. IV (1909) p. 68.

Physcia dimidiata NYLANDER Addenda nova. Observationes. Flora (1881) p. 537. DALLA TORRE et SARNTHEIM Die Flechten von Tirol (1902) p. 162. HARMAND Lichens de France (1909) p. 626.

Parmelia dimidiata ARNOLD Lich. fränk. Jura Flora 1884, p. 170. ARNOLD Zur Lichenen-Flora von München. Ber. d. Bayr. Bot. Ges. I. (1891) p. 33.

EXSIC. ARNOLD 272 (*Parmelia pulverulenta* SCHREB. var. *grisea* LAM.), 1367 (*Parmelia dimidiata* ARN.) MALME Lich. Suec. 156 (*Physcia tribacia* (ACH.) NYL.).

Tab. II, fig. 3.

HARMAND and other lichenologists distinguish between *Ph. dimidiata* NYL. Flora 1881 p. 537, and *Ph. tribacia* NYL. Flora 1874, p. 307, the former species having a »cortex inférieur à hyphes grêles, dirigés généralement dans le sens de la surface et ne se distinguant guère de la couche

médullaire que par un tissu plus dense«, in the latter species »les deux cortex sont en plectenchyme assez regulier«. I have examined the plants of ARNOLD and HARMAND, and recognize the structure of the lower cortex as a sufficient distinguishing character between the two species.

A plectenchymatous lower cortex is never found in Norwegian plants; they belong exclusively to the *Physcia dimidiata*. (sensu HARMAND). But there is a great confusion respecting the names, some authors using the name »*dimidiata*« and others the name »*tribacia*« for our species.

I have not seen the plants of ACHARIUS, and cannot decide whether they belong to the one or the other of the above mentioned species or whether they represent a mixture of both of them. — *Parmelia tribacia* is absent in SOMMERFELT's herbarium and cannot therefore be identified from his plants. But there can be no doubt that it must have been identical with our species, that is so frequent in Norway, and not with the other, otherwise never recorded from our country. It is also probable that SOMMERFELT's plant was not a mixture, but the pure species, described here. If therefore *Lecanora tribacia* ACH. should be a mixture, we can fall back on the name of SOMMERFELT (1826) as the starting point for the nomination of our species.

It is evident from the description by WAINIO that his *Physcia stellaris* * *tribacia* in Adjumenta and in his Pitlekai paper is identical with ours, as is also MALMES plants which I have examined. WAINIO has had access to the ACHARIAN herb. in Helsingfors, and if the ACHARIAN plants should not have been identical with the Scandinavian ones, he would surely have elucidated the question.

Thallus growing in middle-sized rosettes, 2—4 (5) cm. in diam., but inclined to grow in dense clusters, covering larger areas; it is loosely fixed to the substratum. Laciniae more or less ascendent, at the circumference slightly appressed. They are contiguous or imbricate, originally narrow (0,5—1 mm.), in age broader (1—2 mm.), closely imbricate or even panniform. Laciniae multifid, repeatedly deeply incise, furcate or pinnate with undulate or crenate contours, towards the apex from slightly widened to flabelliform. The short lateral branches sorediate at their apices, soredia initiating at the limit between the upper and the lower cortex and at the adjacent parts of the lower cortex, rarely at those of the upper side. Gradually the sorediate apices become ascendant or even incurved, exposing the soredia to wind and air (facilitating their dissemination). Soredia in age expands along the margins, abbreviating the laciniae and occasionally transforming them into a pulvi-

nate mass of sorediate, panniform, short, broad scales. Thallus very fragile. Laciniae more or less convex, of a chalky lustre, without or rarely with few and scattered marginal cilia, minutely rugulose and albomaculate, colour white or whitish-grey, moistened almost unaltered (only a faint tinge of green at the soredia and more distinct white spots). Lower side uncoloured or pale whitish-grey with few, scattered rhizines of the same or a somewhat darker colour.

Thallus covered with a very irregular amorphous, uncoloured stratum, in places breaking up to an insperse mass. Upper cortex from 0 (soredia) to 40–50 or even 140 μ thick, at the exterior part (13–25 μ) greyish, opaque, with very indistinct hyphae, otherwise uncoloured with distinct hyphae. Hyphae plectenchymatous, more or less perpendicular to the surface, especially at the exterior part, very constrictedly septate, thin (3–5 μ) and thin-walled. Gonidia disposed in large, inconspicuous glomeruli, under and in the upper cortex, also in places where soredia are not formed; the distance from the outermost soredia to the surface is accordingly very variable. In appressed laciniae the gonidia are only found within the upper cortex (normal position), in ascendant ones quite as much within either cortex. Medulla white, gradually transformed into the lower cortex which has thicker and more densely interlaced hyphae than the medulla. They are not plectenchymatous, their direction is indeterminate, the majority of them more or less parallel to the surface. Rhizinae 80–105 μ thick.

Apothecia very rare, at least in this country. If developed they are crowded, orbicular or angular, 1–1.5, rarely 2 mm. in diameter. Margin entire or crenate. Receptacle (and margin) frequently sorediate, it is without rhizinae, uniformly coloured (pale); cortex 0–100 (–140) μ thick, with a tinge of grey at the surface, otherwise uncoloured. The plectenchymatous structure less developed than in the upper thalline cortex, hyphae perpendicular to the surface, rather thick-walled, constrictedly septate. Gonidia crowded in the margin and within the whole cortex, also though less numerous under the hypothecium. Hypothecium uncoloured, thick: 50–60 μ . Disc plane, white, very pruinose. Hymenium covered with an uncoloured, amorphous, broken stratum, occasionally containing crystals of oxalate of lime (CaC_2O_4); hymenium 80–100 μ thick, at the exterior part (16–25 μ) dark brownish-red, otherwise uncoloured. Paraphyses at their apices capitato — or clavato — incrassate and distinctly constrictedly septate, unbranched or furcate, or with a few short lateral branches. Asci 60–75 μ long, 15–20 μ thick, well developed, octosporous. Spores (in all the apothecia examined) poorly developed, either entirely

wanting or shrunk and morbid, of a rather constant size, but variable exterior: straight or somewhat fabiform, ellipsoidal or with one contour somewhat flattened, they are rounded at the ends and not constricted at the septum. Cell room rounded, rarely angular, canal indistinct. Colour greyish-brown, normal spores rather translucent. Size 15–20 (23,6) μ long, 8,4–11 μ thick.

Pycnides rare, fertile ones very rare, they are orbicular or later flattened, size 120–160 μ in diam. In young, fertile pycnides the perifulcrum and the adjacent parts of the cortex are black about the ostiolum, otherwise the perithecium is pale, greyish or greyish-brown, in age dark. Pycniconidia straight, cylindrical or narrowly fusiform, 2–4 μ long.

React. No colouring by CaCl_2O_2 , cortex yellow, medulla uncoloured by KOH^1 . Hymenium first blue by J, then at once sordid red, asci subpersistently blue. (On account of the very numerous asci the change of colour is easily overseen in thick sections).

Hab. The habitats of this species is entirely determined by its extreme need of Nitrogen. In the mountains it is an ornithocoprophilous species, found everywhere on large stones, prominent rocks &c., where the birds like to rest, associated with the never-absent *Xanthoria lychnea*, also with *Ramalina strepsilis*, *Parmelia sulcata* and other species. It is frequent on roadside curb-stones (Norw. »stabbesten«), also at the shores of lakes where organic material is deposited during flood-time, on the stone walls under stables &c. Also frequent on suitable wood if the supply of nitrogen is sufficient: wood-fences along the roads, on eaves of birch-bark, on stables (lower part), and in secluded places of different kinds in the country. One of the few *Physciae*, found on *Betula*.

Loc. Curiously enough this conspicuous species has been overlooked by most collectors in our country, and its distribution therefore is insufficiently known. It is not frequent (or overlooked) in the lowlands, but frequent in subalpine positions and very abundant on the mountains; it ascends as high as a Lichen can grow, almost to the eternal snow. There was only one specimen in the herbarium from other collectors, but I have found it almost everywhere on my travels in Norway: Continuously distributed in Eastern Norway from Røros along the lake Fæmunden, Engerdalen and Trysil to Rena, also at Minne. Central Norway: Dovre (ZETTERSTEDT, hb. Ups.); continuously distributed along the Bergen railway, investigated from Hol to Voss: Hol, Gjeilo, Finse, Mjølsfjell, Voss. Recorded from Eide at the inner end of the Hardangersfjord near the quay,

¹ There is, however, a specimen from Assebakke, Karasjok in Finmarken with a positive medullary reaction.

and from Midt-Hordland: Fusa (LILLEFOSSE), Stat (HAVAAS). Trondhjem: Sorgenfri (on Betula, LYNGE). The »*Parmelia tribacia*« of SOMMERFELT¹ from Saltdalen is absent in his herb., but the description agrees with this species. In the Tromsø and Finnmarken districts in Northern Norway it is evidently frequent everywhere: along the coast at Ibbestad, Malangen, Tromsø, Sørkjosen, and Honningsvåg at places where fish is dried, also at Sjaaholmen in Varanger (TH. FRIES s. n. »*Ph. stellaris* (L.) NYL. in formam *adscendentem* transiens«, Herb. Upsala); in the interior abundant on the mountains of Maalselven, Bardo, Dividalen, Lyngen, and Nordreisen, abundant along the road from Lakselv over Skoganvarre and Natvand to Karasjok, and at Assebakte in the Karasjok valley (LYNGE).

Old plants of *Ph. tenella* and *Ph. tribacia* are sometimes convergent. *Ph. tribacia* has broader and shorter, more crenate and lacerate, less ascendant, and more compactly imbricate laciniae.

6. *Physcia pulverulenta* (SCHREB.) NYL.

(var. *allochroa* (EHRH.) TH. FR.)

Lichen pulverulentus SCHREBER Spicil. Fl. Lips. (1771) p. 128. HOFFMANN Enumeratio (1784) p. 76, tab. XII, fig. 2. ACHARIUS Prodomus (1798) p. 112.

Lichen omphalodes WULFEN apud JACQUIN, Collectanea vol. II (1788) p. 196, tab. XV, fig. 2 a et b.

Parmelia pulverulenta ACHARIUS Methodus (1803) p. 210, Lich. Univ. (1810) p. 473, Synopsis (1814) p. 214. KOERBER Syst. Lich. Germ. (1855) p. 86.

Physcia pulverulenta NYLANDER Prodomus (1856) p. (308), Synopsis (1860) p. 419. TH. FRIES Lich. Arct. (1860) p. 62. NYLANDER Lich. Scand. (1861) p. 109. DEICHMANN BRANTH og ROSTRUP: Lichenes Daniae (1869) p. 64. TH. FRIES Lich. Scand. I (1871) p. 136. WAINIO Adjumenta I (1881) p. 131. HUE Addenda Nova (1886) p. 51, Lich. Exot. (1892) p. 112. CROMBIE Brit. Lich. (1894) p. 305. HUE Lich. Extra-Eur. (1900) p. 65. DALLA TORRE et SARNTHEIM Flechten v. Tirol (1902) p. 155. ELENKIN Lich. Ross. Med. (1907) tab. V fig. 7. OLIVIER Lich. d'Eur. I (1907) p. 235. HARMAND Lich. France (1909) p. 632. LYNGE Busk- og bladlaver (1910) p. 103. SANDSTEDT Flechten des n. w. deutschen Tieflandes (1912) p. 236.

¹ SOMMERFELT Supplementum p. 109.

Vid.-Selsk. Skrifter. I. M.-N. Kl. 1916. No. 8.

EXSIC. CLAUDEL et HARMAND Lich. Gall. praecip. 492. FLOERKE Deutsche Flechten 172. FRIES Lich. Suec. 76 (approaches *f. angustata*). FUNCK Crypt. Gew. ed. II, 110. HAVAAS Lich. Norv. 107 (narrow laciniae, approaches *f. angustata*). HEPP Flechten Europas 874 (with good drawing of spores). LEIGHTON Lich. Brit. 49. MIGULA Kryptogamen 13. NORRLINN et NYLANDER 212. RABENHORST Lich. Eur. 96. STENHAMMAR Lich. Suec. 72.

Thallus moderate or large, orbicular, diam. up to 12–13 cm., firm, closely appressed. Rhizinae black, long, penicillately branched or furcate. Laciniae plane and smooth, elongate, narrow: ca. 1 mm. broad, rounded, truncate or emarginate and widened at their ends, otherwise equally broad. Laciniae contiguous or (usually closely) imbricate, multifido-laciniate or repeatedly di- or trichotomously divided with acute angles. The central part of the thallus frequently sprinkled with or even covered by numerous short, undivided or slightly branched narrowly fixed, secondary laciniae. Thallus opaque, without isidia or soredia, but more or less albo-pruinose, especially at the circumference, and on the secondary laciniae, sometimes on the whole thallus. The colour from greyish, brown to nut-brown, sometimes with a tinge of lilac, moistened apple-green, under side black.

Thallus covered with a colourless, amorphous stratum of varying thickness, which later breaks up and forms the pruina. Cortex at the surface yellowish-brown, otherwise uncoloured, 40–80 μ thick, cortical hyphae 5–7 μ thick, distinctly septate, not plectenchymatous, of indeterminate direction, but many of them more or less perpendicular to the surface, at least at the exterior part. Cortical hyphae sometimes growing out as hair-like, pellucid emergences. Gonidia glomerate in a continuous stratum of varying distance from the surface, at times very near it. Medulla white, 130–190 μ thick; its hyphae 3–5 μ thick, loosely interlaced, more or less parallel to the surface, and gradually transformed into the lower cortex. Lower cortex in the inner part uncoloured, otherwise black or brownish-black, 30–50 (80) μ thick.

Apothecia numerous, usually scattered and rounded, diam. 3–5 mm., or crowded and angular, owing to mutual pressure. Margin thick, persistent, entire or more frequently crenate or more or less crowned by thalline lacinuli. Receptacle rugose, black around the centre, otherwise yellowish-grey, without rhizinae. Cortex from 20 (margin) to 200 (centre) μ thick, exterior central part black, otherwise almost uncoloured. Hyphae thick, perpendicular to the surface with small interstices. Gonidia crowded in the margin, numerous within the thin cortical stratum,

very few under the hypothecium, scarcely scattered in the medulla. Disc plane, whitish or bluish-white pruinose, or naked, black or dark brown. Hypothecium pale yellow, up to $50-60\mu$ thick, plectenchymatous. Hymenium covered by a densely inspersed, amorphous, uncoloured stratum. Hymenium at the exterior part brown or reddish-brown, otherwise uncoloured and not inspersed, $130-230\mu$ thick. Paraphyses separating easily, usually undivided, occasionally branched, near their apices indistinctly septate, equally broad or slightly clavato-incrassato above ($3-5\mu$). Asci broadly clavate, $110-140\mu$ long, $26-35\mu$ broad, octosporous. Spores obliquely biseriate, broadly rounded at their ends, straight and only slightly constricted, rarely slightly fabiform, in which case a little more constricted at the septum. Young spores have a small angular lumen and a distinct pore-canal; during maturation the lumen becomes more rounded and the cell wall thinner. Colour dark greyish-brown, at last the spore becomes almost black and opaque. *The breadth is always more than half the length*, the size $24-36\mu$ long, $14,6-20,2\mu$ broad.

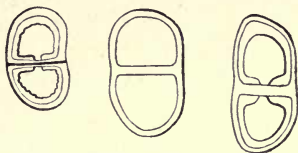


Fig. 7. *Physcia pulverulenta* var. *allochroa* (Ehrh.) Th. Fr.

Pycnides numerous, but easily overlooked, owing to the entirely uncoloured perifulcrum. They are large: $240-320\mu$ high and $240-250\mu$ broad. Pycnoconidia cylindrical, straight or slightly curved, $4-6\mu$ long.

Reaction: Cortex and medulla uncoloured by KOH as well as by CaCl_2O_2 . Hymenium first blue, then vinous by J.

Hab. The var. *allochroa* is distinctly a lowland species, not known higher than 600 meters above sea level (Hol), and very rare indeed at that elevation. It requires air and light, and is found on the bark of large trees in open situations (avenue-trees, isolated groups of *Fraxinus*, *Populus*, *Alnus*, *Acer*, *Tilia* — not on *Betula*). It is very rarely found on stone (Moster, moist Atlantic climate).

It is a species chiefly of south-eastern distribution. There is hardly any *Physcia* more frequent about the Kristiania-fjord. It is much less frequent along the southern and western coast and especially at the inland end of the great western fjords. I have not seen quite typical states north of Trondhjem (Drontheim). In Northern Norway it is replaced by *angustata*-forms.

Loc. Numerous habitats around Kristiania (M. N. BLYTT, N. LUND, N. G. MOE), in old times also from the town itself, where the smoke has

now made its existence impossible. Also from numerous stations on the south-eastern lowland: Eidsvold (LAUDER LINDSAY), Ringebu (SOMMERFELT), Helgøen, Brandbu, and Minne (LYNGE), Aarnes (HOCH), Sundvolden (HAVAAS, Modum (MOE), Norderhov (NORMAN), Hersjøen, Aas (LYNGE), Skien (HOCH). It cannot be frequent in the great valleys of central Southern Norway, for it is only recorded from Hol (Hallingdal, LYNGE). Along the south coast recorded only from Dybvaag (near Lyngør, LYNGE), along the west coast here and there on old trees, and also on rocks (Moster, HAVAAS). Rare in Hardanger: Strandebarm (LILLEFOSSE), Eide (HAVAAS), and in Sogn: Hafslo (HAVAAS). At Voss it is found abundantly on deciduous trees in a forest of *Picea excelsa*, a habitat of several eastern plants, and at Graasiden (LYNGE). Near Trondhjem (Drontheim) at Ilsviken (KINDT) and Sorgenfri (OXAAL and LYNGE).

I have neither seen the plants from »Nordlandia meridionalis« nor from Alten, mentioned by TH. FRIES¹, but I suppose them to belong to var. *angustata*.

f. *turgida* SCHAEER.

Parmelia pulverulenta ♂ *turgida* SCHAEERER Enumeratio critica (1850) p. 38.

Central laciniae turgid, small, papillate or verrucose, peripheral laciniae broad and flat. Thallus without pruina, colour nut-brown or greyish-brown.

A form not very noteworthy, closely related to var. *allochroa*.

Saltdalen (SOMMERFELT, s. n. *Parmelia venusta* β. *hybrida* ACH. and *Imbricaria* ∴ *Parmelia aipolia* β. *cercidia* ACH.) Near Kristiania: Tveten (LYNGE).

var. *angustata* (HOFFM.) NYL.

Lichen angustatus HOFFMANN Enumeratio (1784) p. 77, tab. XI, fig. 2.

Parmelia pulverulenta var. *angustata* ACHARIUS. Lich. Univ. (1810) p. 474, Synopsis (1814) p. 214. KOERBER Syst. Lich. Germ. (1855) p. 87.

Parmelia pulverulenta var. *angustata* NYLANDER, Synopsis (1858—60) p. 420, Lich. Scand. (1861) p. 110. TH. FRIES Lich. Scand. I (1871) p. 137. CROMBIE Brit. Lich. (1894) p. 307. HUE Lich. Extra-Eur. (1900) p. 66. OLIVIER Lich. d'Eur. I (1907) p. 236. HARMAND Lich. France (1909) p. 634.

¹ Lich. Scand p. 137.

EXSIC. MALME Lich. Suec. 180.

Tab. II, fig. 4.

Differs from var. *allochroa* in having long, narrow laciniae, which are dichotomously and more divaricately branched, entirely discrete or only contiguous at the apices. Laciniae continuous from the centre to the circumference. Colour deep nut-brown or greyish-brown, moistened greenish. The laciniae may be somewhat shining; they are pruinose, especially at the apices, pruina white or frequently with a tinge of violet. Owing to the divaricate branching of the laciniae the thallus is seen resting on a cushion of conspicuous, long, thickly branched, black rhizinae.

Apothecia not rare, usually pruinose, but often naked (even in the same specimen), with thin usually entire margin, without or (rarely) with folioli.

Otherwise as in the type and connected with it by innumerable intermediate states with shorter, more or less contiguous laciniae. The colour is probably the best criterion.

»Typical« states are frequent in Northern Norway — mixed with the intermediate states — on the smooth bark of *Alnus incana* along the rivers: Lyngen (Kitdalen, Lulle, and Lyngseidet, LYNGE). Maalselven (Solli, Likkavarre, Strømsmo, LYNGE); from Saltdalen (hb. SOMMERRFELT). Typical states are not frequent in Southern Norway, but intermediate states are often seen. Norderhov (hb. NORMAN), Minne near Eidsvold (LYNGE), near Kristiania (Kolsaas and Leangen, LYNGE). Western Norway: Voss (Brynsbro, HAVAAS).

f. *superfusa* A. ZAHLBR.

Physcia pulverulenta f. *superfusa* A. ZAHLBR. Krypt. Exsic. (1909) no. 1670. HARMAND Lich. France (1909) p. 634.

Tab. II fig. 1.

Differs from var. *angustata* in having still longer and narrower laciniae, which are entirely covered by a white pruina; laciniae dichotomously and divaricately branched.

Specimens from Northern Norway (Strømsmo in Bardo, LYNGE) agree entirely with the authentic specimens of ZAHLBRUCKNER; they are found on the smooth bark of *Sorbus Aucuparia* and *Alnus incana*, associated

with var. *angustata*. Less pruinose states, intermediate between f. *superfusa* and var. *angustata*, are known from Minne near Eidsvold and Kolsaas near Kristiania (LYNGE). — It has a wide distribution: Crimea (MERESCHKOWSKY), Steiermark (ZAHLEBRUCKNER), France (HARMAND), and Norway.

var. *argyphaea* (ACH.) NYL.

Parmelia pulverulenta var. *argyphaea* ACHARIUS. Lich. Univ. (1810). p. 474, Synopsis (1814) p. 214.

Parmelia pulverulenta var. *argyphaea* NYLANDER Lich. Scand. (1861) p. 109. TH. FRIES Lich. Scand. I (1871) p. 137. CROMBIE Brit. Lich. (1894) p. 306. DALLA TORRE et SARNTHEIM Die Flechten von Tirol (1902) p. 156. OLIVIER Lich. d'Eur. I (1907) p. 236. HARMAND Lich. France (1909) p. 634.

EXSIC. ANZI Lich. Ital. sup. 122 (not 123 »var. *argyphaea* f. *polita* FLW.). SCHAER. Lich. Helv. 356 (s. n. *Parmelia pulverulenta* α *allochroa* a. *corticola* SCHAER.).

Differs from var. *allochroa* in having firmer closely imbricate, short laciniae with widened apices, and especially by the entirely albo-pruinose thallus and apothecia.

I have seen entirely milk-white specimens from Southern Europe. No such specimens have hitherto been detected in Norway, but several of the *allochroa*-specimens approach it closely. A fertile muscicolous specimen from Lyngseidet in Northern Norway (LYNGE) apparently belongs to f. *argyphaea*; its exterior approaches *Ph. muscigena*, but the chemical reaction of the hymenium is »J first blue, then immediately sordid vinous red«. —

f. *venusta* (ACH.) NYL.

Parmelia venusta ACHARIUS Methodus (1803) p. 211, et tab. VIII, fig. 5, Lich. Univ. (1810) p. 475.

Physcia venusta (ACH.) NYL. DALLA TORRE et SARNTHEIM Die Flechten von Tirol (1902) p. 157.

Physcia pulverulenta var. *venusta*. NYLANDER Prodrum (1857) p. 308. Synopsis (1858—60) p. 421. Lich. Scand. (1861) p. 110. TH. FRIES Lich. Scand. I (1871) p. 138. HUE Lich. Exot. (1892) p. 112 (as subspecies).

CROMBIE Brit. Lich. (1894) p. 308 (as subspecies). HARMAND Lich. France (1909) p. 635. LETTAU Lich. Thür. (1913) p. 255.

The margin of the apothecia crowned by numerous short or long folioli. Thallus without or only with little pruina; the margin of the laciniae more or less crenate or incised. Colour cervine or cervine greyish.

Our herbarium possesses one specimen of f. *venusta* from Croatia, collected by BAUMGARTNER, which is entirely conformable to the description of ACHARIUS. The margin of the laciniae is so incised that the whole thallus acquires a microphylline appearance and the apothecia are almost hidden in the crown of folioli. Such specimens are unknown in Norway. — Mr. BAUMGARTNER has informed me that he cannot regard the *venusta* as a proper species, and I am of the same opinion.

Specimens of var. *allochroa* with more or less crowned apothecia and nearly epruinose laciniae are frequent in Norway, and some of them are so conspicuously crowned that they might be referred to f. *venusta*, (Mosterhavn, HAVAAS and LYNGE), but all intermediate states are found.

NYLANDER found a »stratum thalli corticale cellulosum«¹. Our specimen from Croatia has a cortex similar in structure to that of the typical *Ph. pulverulenta*.

7. *Physcia muscigena* (ACH.) NYL.

Parmelia muscigena ACHARIUS Lich. Univ. (1810) p. 473. Synopsis (1814) p. 212.

Lichen muscigenus WAHLENBERG Flora Lapp. (1812) p. 422.

Physcia pulverulenta var. *muscigena* NYLANDER Synopsis I (1860) p. 420. TH. FRIES Lich. Arct. (1860) p. 63. NYLANDER Lich. Scand. (1861) p. 110. KINDT Bidrag til Kundskab om Trondhjems Lavvegetation. Kgl. Vid. Selsk. Skr. (1880, edit. 1881) p. 29. HARMAND Lich. France (1909) p. 636. LYNGE Busk- og blad-laver Berg. Mus. Aarb. (1910) no. 9 p. 104.

Physcia pulverulenta subsp. *muscigena* WAINIO Adjumenta I (1881) p. 131. ARNOLD Jura (1885) p. 60. CROMBIE Brit. Lich. I (1894) p. 309.

Physcia muscigena NYLANDER Prodrum Lich. Gall. (1857) p. 308. DALLA TORRE et SARNTH. Die Flechten von Tirol (1902) p. 157.

¹ NYLANDER Synopsis I. c.

Exsic. ANZI Lang. 54 B, ANZI Lich. Ven. 21, ARNOLD 64 a, HEPP 875, SCHAEER. 486.

Thallus up to 12—13 cm. large, fragile, easily loosened from the substratum. Laciniae imbricate, at the circumference usually slightly appressed, in the centre more or less ascending. They vary: short and broad (to 3—4 mm. broad) laciniae, ascending even at the circumference, with their ends widened like a fan, profoundly incised with crenate lacinuli, — or long and narrow (0,5—0,7 mm.), plane, multifid, dior trichotomously branched, with rounded or truncate ends. More rarely the laciniae are short and narrow to filiform (0,2—0,5 mm. broad), multifid, ascending or erect, closely imbricate or even panniform. Surface opaque, smooth, without soredia, usually without (in var. *isidiata* m. with) isidia. Thallus with white, caesious, or bluish violet pruina, either only at the ends of the laciniae or over the whole surface. Colour brownish, more or less dark chestnut-brown or greyish-brown (varies also with the pruina), moistened with a distinct tinge of green. Below black, paler at the circumference (sometimes the pale part is rather broad), covered by numerous, long, branched black rhizinae, 40—80 μ thick at their base.

Thallus covered by a colourless, very insperse, 8—22 μ thick stratum, which forms the pruina. Upper cortex 10—45, usually 20—30 μ thick. It is not plectenchymatous, its hyphae are very entangled, more or less perpendicular to the surface, they are constrictedly septate and have a relatively thick cell wall. Gonidia crowded in glomeruli sometimes only covered by the amorphous stratum, usually deeper in the thallus. Medulla white, 100—160 μ thick. Lower cortex black or brownish-black, 25—40 μ thick.

Apothecia are not frequent. They are sessile, scattered and orbicular with a diam. of 3—5 mm., sometimes crowded and angulose. Margin thick persistent, entire or crenate, frequently with folioli which are sometimes so numerous and long that the apothecia look immersed in the thallus. Receptacle about the centre black, its cortex 200—220 μ thick, paler and much thinner at the circumference, built of pachydermatous hyphae perpendicular to the surface. Gonidia crowded in the margin of the apothecia within the thin cortex, few and scattered in the medulla, absent within the black cortex. Disc plane, black, more or less pruinose. Hypothecium pale, 20—50 μ thick. Hymenium 100—140 μ thick, at the exterior part more or less dark brown, very insperse, otherwise uncoloured and not insperse. Paraphyses at their ends always clavately incrassate (4—5 μ)

and constrictedly septate; they are undivided, or sometimes with few short branches at the exterior part. The asci vary: long and narrow ($90-125\ \mu$ long, $18-22\ \mu$ broad), or short and broad ($80-90 \times 27-30\ \mu$), always octosporous. Spores obliquely biseriate more or less unto very constricted at the septum, rounded, rarely slightly apiculate at the ends, cell room rounded or rarely angulose, diaphragma thin in ripe spores. Spores narrower than in *Ph. pulverulenta*: The breadth is seldom larger than half the length: (19) $22-29$ (33) μ long, $10.5-14.6$ (16) μ broad.

Pycnides are not frequent; they are easily overlooked owing to the entirely uncoloured perifulcrum. They are globose with a slightly prominent ostiolum. Pycnoconidia straight, cylindrical, rounded at the ends, $3.5-5\ \mu$ long.

Reaction. Cortex and medulla uncoloured by KOH as well as by CaCl_2O_2 . Hymenium persistently blue with J.

Hab. *Physcia muscigena* is found on mossy rocks, especially in alpine positions, also on bare stone. It prefers schistose or chalky substratum. In Southern Norway it descends to the sea level only on such substratum; in Northern Norway it is equally frequent at all elevations.

Loc. Near Kristiania: St. Hanshaugen (MOE, 1866, now destroyed, and Snarøen (LYNGE) on silurian strata near the sea. Central lowlands not frequently: Ringebu (SOMMERFELT), south-eastern valleys very frequent along the elevated valleysides and on the mountains: Tønset (LYNGE), Otta (HAVAAS), Vaage (SOMMERFELT), Lom (NORMAN), Otta (TH. FRIES), Slidre (SOMMERFELT); it is also very frequent along the central high mountains from Dovre (several loc., SOMMERFELT, M. N. BLYTT, LAUDER LINDSAY, and others) over Finse (LYNGE) to Hardangervidden (several loc., HAVAAS). Not known from the lowlands of Western Norway, not found in Granvin in Hardanger (HAVAAS), but frequently on the western mountains (HAVAAS). Recorded from Sundalen (several loc., HAVAAS). There is only one station in the poorly explored Trondhjem (Drontheim) district, Ladehammern, on moss (KINDT); not recorded (but certainly present) from Southern Nordland, which has been still less investigated. North of Salten (SOMMERFELT) it is frequent in suitable places, evidently more frequent or perhaps better explored — along the coast than in the interior: Tromsø amt along the coast: Gibostad, Malangen (LYNGE), Fløifjeld (HAVAAS), Skjærvø (NORMAN), in the interior: Sollitind (LYNGE); Finnmarkens amt:

Alten (several places, M. N. BLYTT and others, Renøen (NORMAN), Vadse (HAVAAS), Mortensnes (TH. FRIES), and in the interior: Børselv (NORMAN), and Skoganvarre (LYNGE).

Physcia muscigena is a very variable plant. The variation of the laciniae has been described above. The colour of the lower side is usually black, but varieties with pale lower side have been described (f. *lenta* ACH., and f. *squarrosa* ACH.). In our herbarium there are several specimens in which the appressed laciniae at the circumference are black with the exception of a very narrow apical zone, whereas the central erect laciniae are pale, either persistently or at least for a long time. The formation of the black colour is evidently hindered by strong insolation. — ACHARIUS writes »apotheciis . . . margine integer«¹. In reality the apothecia are nearly always crenate or even appendiculate.

Ph. muscigena is well separated from *Ph. pulverulenta* by the smaller, narrower and more constricted spores, by the J. reaction of the hymenium, as well as by its ascending laciniae and its peculiar habitus. Its habitus is faithfully preserved even when growing on maritime rocks in Southern Norway.

Several varieties have been described, but they are connected with the type by many intermediate states. — I have not seen f. *minuta* WAIN. (»Thallus minor, laciniis brevioribus et angustioribus, circ. 0,75—0,33 mm. latis, planis vel convexiusculis, rhizinis minus evolutis«)². A specimen from Dovre (»*Parmelia aquila* c. *stippea* ACH.«, hb. SOMRFT.) probably belongs to f. *minuta* WAIN.

f. *lenta* (Ach.).

Parmelia pulverulenta β *lenta* ACH. Lich. Univ. (1810) p. 473.

Physcia pulverulenta var. *lenta* ACH. TH. FRIES Lich. Scand. I (1871) p. 138. *Ph. pulv.* var. *muscigena* f. *lenta* ACH. HARMAND Lich. France (1909) p. 636. *Ph. pulv.* muscigena* f. *lenta* ACH. WAINIO. Adjumenta I (1881) p. 132.

According to HARMAND Lich. France p. 637 SCHAEERER Lich. Helv. 486 belongs to the f. *lenta* (ACH.). In our copy of the collection No. 486

¹ Lich. Univ. p. 472.

² Adjumenta I (1881) p. 132.

has a black lower side and narrow elongate laciniae, and cannot be referred to *f. lenta*.

The whole thallus covered with a white or greyish-white pruina; when moistened, the thallus is more or less dark greyish-green. Lower side white, in the central part only more or less dark. Rhizinae scattered, pale or finally dark. Laciniae at first slightly appressed, but during the growth they become more or less ascendent. They are broad and short, deeply incise with rounded ends, the ascendent ones slightly crisp at the margins.

This variety is not frequent in Norway. I have only seen it from Northern Norway: Saltdalen (hb. SOMFT.), and Tromsøen (hb. BLYTT). The specimens were sterile.

f. squarrosa (ACH.)

Parmetia muscigena γ *squarrosa* ACHARIUS Lich. Univ. (1810) p. 473.

Physcia pulverulenta var. *squarrosa* ACH. TH. FRIES Lich. Scand. I (1871) p. 138.

EXSIC. ARNOLD 64 b. KOERBER Lich. sel. Germ. 102. (*Anaptychia ciliaris* γ *humilis* KBR.).

Differs from the type in having erect, more or less closely imbricate to panniform laciniae, which are equally broad or at their ends dilated and crenate. Pruina is found from the ends of the laciniae in various extensions towards the centre. Colour greyish or bluish-violet to greyish-white or white, lower side at least at the ends of the laciniae pale, but it becomes darker towards the central part.

Apothecia as in the type.

f. squarrosa is hardly a noteworthy form, connected with the type by numerous intermediate states. It is especially found in Northern Norway. Finmarken: Honningsvåg (HAVAAS) and Skoganvarre (LYNGE), Tromsø amt: Skibotn, Lyngseidet, Tromsøen, Nordbynesset, and Rostavand (LYNGE).

In our copy of KOERBER's exsiccate No. 102 is different from TH. FRIES's specimens of *Ph. pulverulenta* δ *tenuis* (KBR.); these belong to *Ph. constipata*, here treated as a proper species.

var. *isidiata* LYNGE nov. var.

Thallus dense isidiatus. Praeterea ut in typo.

Prope villam urbicam Ulstad par. Lom Norvegiae centralis. Supra muscos in latere rupium, ca. 430 m. s. m. (LYNGE).

The isidia are short, papillose or with one initial branching. Colour deep brown or brownish-violet, thallus covered with a bluish-violet pruina. Laciniae short and broad, appressed to the substratum. The thallus is thinner than usually in *Ph. muscigena*, but the anatomy is the same. The isidia are clad with a thin (9—11 μ thick) cortex, built up of more closely interlaced hyphae than the normal cortex. Lower side black.

The specimen was sterile. Pycnides could not be detected, which is, however, frequently the case with isidiose lichens.

The presence or absence of soredia is in my opinion a mark of importance, which will generally give title to a specific rank. I have here only given it the rank of a variety, because the general appearance (habitus) and the anatomy in nearly every other respect were those of *Ph. muscigena*. I do not know of any two species (petites espèces) differing only in one character. A close investigation will always reveal not one or two but quite a series of distinguishing marks, as is the case with the »petites espèces« of the *Parmelia olivacea*-group.

I can also remember having seen this variety in Karesuando, the most northern parish of Sweden.

8. *Physcia constipata* (NYL.) NORRL. et NYL.

Physcia pulverulenta δ *temis* (KBR.) TH. FRIES Lich. Scand. I (1871) p. 137.

Physcia muscigena var. *constipata* NYLANDER in sched. NORRLIN Berättelse i anledning af en till Torneå Lappmark verkställd naturalhistorisk resa. Not. Sällsk. pro Fauna et Flora Fenn. Förh. vol. XIII (1873) p. 326.

Physcia ulothrix * *subciliaris* NYLANDER in NORRLIN Flora Kareliae Onegensis II (Lichenes). Meddel. Soc. Fauna et Flora Fennica I (1876) p. 20.

Physcia obscura * *constipata* WAINIO Adjumenta I (1881) p. 134.

Physcia constipata OLIVIER Lichens d'Europe I (1907) p. 244 (168).

EXSIC. NORRL. et NYL. Herbarium Lichenum Fenniae no. 218 (1882, s. n. *Physcia constipata*).

TH. FRIES referred his specimens to »*Anaptychia ciliaris* γ *humilis* KBR. Parerga p. 19«. They do not, however, agree with KOERBER Lich. Sel. Germ. no. 102, which is a *Physcia muscigena*, but with NORRL. et NYL. No. 218. — NYLANDER proposed his »*constipata*« as a variety in 1873, as a species in 1882.

Thallus moderate or large, 6—10 cm., very fragile. Laciniae ascendent or erect, closely imbricate or even panniform, but usually free at their apices; they are thin and narrow, lacerato-incise at their apices. Colour greyish or greyish-brown, under side of the same colour or entirely uncoloured. Laciniae smooth, without isidia or soredia, epruinose or (nearly imperceptibly) pruinose at their apices (strong lens). There are some scattered, pale or nearly uncoloured rhizinae along the margin of the laciniae, and very few on the under side.

Upper cortex plectenchymatous, uncoloured, 25—30 μ thick, hyphae distinct, pellucid, constrictedly septate with rounded articuli. Gonidia arranged in a very regular stratum under the upper cortex, also in scattered glomeruli within the lower cortex. Lower cortex uncoloured or only pale brown about the rhizinae, on erect free laciniae distinctly marked out from the medulla, plectenchymatous, and built as the upper cortex, on closely imbricate laciniae only locally plectenchymatous, usually gradually transformed into the medulla, and with hyphae parallel to the surface.

Apothecia not seen.

Pycnides with a prominent ostium, globose, diam. 130—160 μ . Peridium uncoloured or of a pale brown colour, darker at the ostium. Pycnoconidia broadly cylindrical with rounded apices, 3,5—4 μ long.

Reaction: Cortex and medulla uncoloured by KOH as well as by CaCl_2O_2 .

Loc. Central Norway: Gudbrandsdalen between Øien and Kleivstad, Northern: Storviksnesset in Alten and Ald in Varanger (TH. FRIES s. n. *Physcia pulverulenta* (SCHREB.) NYL. γ *humilis* (KBR.) NYL. The specimens preserved in the botanical museum of Upsala.

I have never seen it in nature, but the pale colour, narrow, lacerate, usually epruinose laciniae with marginal rhizinae entitle it to a specific

rank. In my opinion it approaches *Ph. muscigena* more than *Ph. obscura* — It is found on mossy ground, in the specimens associated with *Ph. muscigena*. Intermediate states have not been observed.

9. *Physcia grisea* (LAM.) A. ZAHLBR.

Lichen griseus LAM. Encycl. Méthod. Botan. vol. III (1789) p. 480.

Lobaria pulveracea HOFFMANN Deutschl. Flora (1796) p. 153.

Lichen pityreus ACHARIUS Prodromus (1798) p. 124.

Parmelia pityrea ACHARIUS Lich. Univ. (1810) p. 483.

Physcia pulverulenta var. *pityrea* NYLANDER Prodromus (1856) p. 308. NYLANDER Synopsis (1860) p. 420. NYLANDER Lich. Scand. (1861) p. 110. TH. FRIES Lich. Scand. I (1871) p. 136. LYNGE Blad- og busklaver (1910) p. 104.

Physcia pityrea (as subsp.) CROMBIE Brit. Lich. I (1894) p. 308.

Physcia farrea f. *pityrea* WAINIO Adjumenta I (1881) p. 132. HARMAND Lich. France (1909) p. 640.

Physcia pulveracea WAINIO Lich. Sibir. merid. (1894) p. 14.

The synonymy of this species is very intricate. According to ZAHLBRUCKNER's Schedae ad Krypt. Exsic. No. 1980 the name of LAMARCK is the valid one.

With the exception of the var. *semifarrea* WAIN. the Norwegian varieties of this species seem to be confluent and very difficult of limitation. It is still more difficult to identify them with the numerous varieties, described by other authors, when authentic specimens are not at our disposal.

Thallus 5—9 cm. large, appressed to the substratum or with ascending or erect laciniae. Laciniae usually (towards the centre always) contiguous or even imbricate, often instructed with short, narrowly affixed secondary laciniae. Laciniae usually not over 5—7 mm. long, only at the circumference distinctly stellate. Thallus without isidia, but sorediate along the sides of the laciniae, on the central ones also at the ends. On old thalli the soredia sometimes cover the whole surface. Soredia white, yellowish-white or greenish. Pruina is always found on the apical part of the laciniae and sometimes spreads over the whole thallus. Colour white, grey, brown or cervine (often determined by the pruina), moistened greenish. The colour of the lower side vary: Entirely uncoloured or uncoloured at the circumference and black only in the centre.

Thallus covered with an amorphous colourless stratum of varying thickness. Upper cortex from 0 (soredia) to 50 or even $75\ \mu$ thick; at the exterior part it is more or less dark, otherwise uncoloured. Hyphae spreading like a fan from between the glomerate gonidia, more or less closely interlaced and sometimes almost plectenchymatous; they are $3-5\ \mu$ thick, branched, hardly constricted at the distinct septa. Medulla white or sometimes very faintly yellow, with loosely interlaced horizontal hyphae, more or less distinctly marked out from the lower cortex, which also consists of horizontal but more pachydermatous hyphae. The lower cortex uncoloured in young laciniae, in old laciniae its exterior part is at least at the centre locally or extensively coloured dark, dark-brown or even black. Lower cortex $25-50\ \mu$ thick, rhizinae branched, diam. up to $130\ \mu$.

Apothecia rare, sessile, but not appressed, diam. up to 3 mm. Margin crenate or even appendiculate, sometimes sorediate, disc pruinose. In some apothecia the gonidia are very numerous, crowded, filling up the whole medulla of the receptacle. Spores frequently with oil drops, $26-34.5\ \mu$ long, $14.4-18.5\ \mu$ thick.

The form of the spores as well as the other carpological characters as in *Ph. pulverulenta* var. *allochroa*.

React. The yellowish soredia and medulla are coloured more distinctly yellow by KOH. Otherwise cortex as well as white soredia and medulla are neither coloured by KOH nor by CaCl_2O_2 . Hymenium first blue, then at once deep vinous by J.

Ph. grisea includes plants of a very considerable variation. I have tried to describe the varieties in the following manner.

f. *alphiphora* (ACH.) LYNGE comb. nov.

Parmelia farrea f. *alphiphora* ACHARIUS Lich. Univ. (1810) p. 476.

Physcia ** *farrea* f. *alphiphora* WAINIO Adjumenta I (1881) p. 132.
HARMAND Lich. France (1909) p. 640.

Exsic. CLAUD. et HARM. Lich. Gall. 495.

Laciniae appressed, contiguous or subdiscrete, narrow, equally broad or slightly widened at the ends, multifid, pinnately or dichotomously branched. Peripheral laciniae sorediate along their sides only and there-

fore relatively long and stellate, central laciniae sorediate also at their ends. The whole thallus covered with white pruina. Colour white or in the central part greyish or yellowish-grey from confluent soredia of that colour, lower side white at the circumference, dark to black towards the centre, with long, much branched rhizinae of the same colour.

Our museum possesses a Finnish specimen, collected by LÅNG, with a herbarium note (by LÅNG) »cum typo Acharii exacte congruens«. It has narrow, elongate, very multifid, subdiscrete white laciniae, the colour of the lower cortex as above described, and quite tomentose from long black rhizinae. The Norwegian specimens are coarser with contiguous laciniae, but otherwise conformable.

Found near Kristiania: Wettre in Asker on Salix (LYNGE); and near Minne (LYNGE). Typical states are not frequent, but it is by numerous intermediate states connected with var. *pityrea*. The specimens from Minne are quite conformable to CLAUD. et HARM. Lich. Gall. No. 495 (*Ph. pulverulenta* var. *leucoleiptes* TUCK. f. *argyphaeoides* HARM.

var. *pityrea* (ACH.) LYNGE comb. nov.

Parmelia pityrea ACHARIUS Lich. Univ. (1810) p. 483. — I consider this variety to be the »centre«, the type of the species. The other varieties are grouped around it as more or less confluent variations.

Exsic. CLAUD. et HARM. Lich. Gall. 73, FLOERKE Deutsche Lich. 47, FRIES Lich. Suec. 105, HAVAAS Lich. Norv. 456, HEPP Flecht. Eur. 876, MALBR. Lich. Norm. 70, MIGULA Krypt. 120, ZAHLBRUCKNER Krypt. Exsic. 1980.

var. *pityrea* is a coarser plant with contiguous or imbricate laciniae, colour white, greyish-white or grey. Pruina white or greyish white, rarely with a tinge of blue, more or less profusely distributed over the whole thallus. Soredia as in f. *alphiophora*, their colour white or frequently yellowish. Lower side occasionally entirely uncoloured, but usually more or less darkened to black towards the centre.

Found fertile in Norway (Description of the apothecia above).

Hab. Grows on the bark of deciduous trees, but not recorded on *Betula*.

Loc. It is a plant from our south-eastern lowlands, not recorded north of Dovre: Near Kristiania it is frequent: Bryn, Bygdø, Bærum, and Asker (several, stations, LYNGE); Minne near Eidsvold (LYNGE), Toten and Øier (SOMMERFELT s. n. *Parmelia pulverulenta*), Vestfjorddalen in Telemarken (LYNGE), Sell in Gudbrandsdalen (HAVAAS). It is very rare along our western coast (only from Dalsbø on Stat, HAVAAS); in Western Norway it is otherwise only known from Voss (HAVAAS), where many eastern plants occur.

It is a rare thing to find a quite typical var. *pityrea* in Norway. Usually the lower cortex is more or less dark towards the centre. HUE and HARMAND would refer the greater part of our material to var. *leucoleiptes* TUCK.

The soredia are either white or quite as frequently yellowish, and in that case more distinctly yellow by KOH. The medulla is also sometimes (very faintly) yellowish. HARMAND names such plants f. *enteroxanthella*, OLIVIER even raises them to specific rank¹. Yellow soredia occur in all our varieties of *Ph. grisea*. Lichens quite conformable to HARMAND. Lich. Gall. praecip. 268 (*Ph. pityrea* var. *enteroxanthella* HARMAND) are not rare round about Kristiania.

CROMBIE found the thallus of *Ph. virella* suffused with chrysophanic acid and accordingly violet with KOH². I found the same on *Physcia grisea* var. *pityrea* from Stat (HAVAAS).

var. *detersa* (NYL.) LYNGE comb. nov.

Physcia pulverulenta var. *detersa* NYLANDER Synopsis (1860) p. 420. NYLANDER Lich. Scand. (1861) p. 110. TH. FRIES Lich. Scand. I (1871) p. 138.

Exsic. NORRL. et NYL. Herb. Lich. Fenn. 213.

Thallus middle-sized or larger, diam. up to 8—9 cm. Laciniae appressed, short, only at the circumference distinctly stellate. They are closely contiguous or imbricate, multifid, the narrower ones pin-nate, the broader ones widened at the ends like a fan and coarsely crenate or digitate. Thallus smooth, opace or slightly shining at the circumference, without isidia, but sorediate: soredia begin-

¹ HARMAND Catal. Lich. Lorr. p. 231, OLIVIER Lich. Eur. p. 298.

² CROMBIE Brit. Lich. I, p. 320 (f. *flavescens* CROMBIE).

ning along the sides of the laciniae, in central laciniae also at their apices, and sometimes covering the whole surface. Thallus (with us only slightly) pruinose at the apices of the laciniae, pruina whitish or pale bluish. Colour chest-nut brown or cervine, sometimes with a tinge of grey, soredia white or yellowish. Lower side black, rhizinae black (only young rhizinae along the circumference are pale), from undivided to much branched.

Thallus covered with a thin amorphous stratum. Upper cortex with an exterior, brownish or yellowish-brown, equally thick (14—16 μ) part, a thicker interior part is uncoloured. The thickness of the cortex is very variable, from 0 (soredia) to 80 μ . Its hyphae 4—5 μ thick, septate, but only slightly constricted; at the interior part of the cortex they spread irregularly, at the exterior part they are perpendicular to the surface. Gonidia glomerate, of a very variable distance from the surface. Medulla white, lower cortex black, up to 50 μ thick.

Apothecia not seen in Norwegian specimens¹. Pycnides not rare, globose or somewhat prominent at the ostiolum, diam. 130—160 μ . Perifulcrum dark around the ostiolum, otherwise uncoloured. Pycnoconidia straight, cylindrical, 3—4 μ long.

React. When yellowish, the soredia are coloured more distinctly yellow by KOH. —

The var. *detersa* is rare in Norway, and is only known from our Central Lowlands: Ringeby (hb. SOMMERFELT s. n. »*venusta*« β *hybrida* ACH., *pulverulenta* var. *hybrida* SOMMERFELT²), Norderhov (hb. NORMAN), and from Minne, near the railway bridge, at Betula (LYNGE).

HUE considers var. *leucoleiptes* TUCK. and var. *detersa* NYL. as synonymous plants. NYLANDER's plant in Herb. Lich. Fenn. No. 213 is almost epruinose with narrow pinnato-multifid laciniae, whereas TUCKERMAN's plant in Lich. Amer. sept. No. 107 has coarser and very pruinose laciniae. The habitus is different, but these characters are variable in *Physcia*, and it is probable that HUE is right. MERRILL's plant in Lich. Exs. No. 118 is more like our Norwegian ones.

In any case the Norwegian plants can with certainty be referred to var. *detersa* NYL. (Herb. Lich. Fenn. No. 213).

Great importance has been attributed to the colour of the lower side. HUE and after him HARMAND are of opinion that a black lower side is a

¹ According to NYLANDER Synopsis p. 420 the spores are large: 27—44 \times 14—20 μ .

character of sufficient importance to separate var. *leucoleiptes* from *Ph. grisea* and to refer it to *Ph. pulverulenta*. I do not agree with this view.

In some of the Norwegian specimens the white colour has been preserved over the whole lower face, in others there is a marginal uncoloured zone, whereas the central part is dark. The rhizinae are first coloured, then the adjacent part of the lower cortex, and at last the dark spots become confluent.

ACHARIUS did not attribute much importance to the colour of the lower cortex. His *Parmelia farrea* α^1 is »subtus albido fibrillis fusconigris« and his var. β *alphiphora* of the same species is »subtus atro-tomentoso«. In reality its cortex is also black. — HARMAND is also doubtful, for his f. *brunnea*² has a »face inférieure largement pale, ce n'est que vers la base qu'apparaît le brun ou le brun-noirâtre«, a very correct observation.

After HUE and HARMAND there would be many parallel varieties of *Ph. pulverulenta* and *Ph. grisea*, for almost every one of the *Ph. grisea* varieties here described has specimens with more or less darkened lower face.

It seems to me that such characters are not suited to separate between different species. We shall have a more natural arrangement, if we refer sorediate varieties to *Ph. grisea* and esorediate varieties to *Ph. pulverulenta*. The latter species always has a black lower face, the former a variable colour, in some varieties an entirely — or at least partly — black lower side, in others an uncoloured one.

var. *detersa* is here limited to chestnut or brown plants with a black lower surface. HARMAND's var. *leucoleiptes* also comprises plants with whitish pruinose laciniae.

var. *semifarrea* (WAIN.) LYNGE comb. nov.

*Physcia (pulverulenta) ** farrea* ACHARIUS f. *semifarrea* WAIN. Adju-
menta I (1881) p. 132.

Physcia pulverulenta var. *leucoleiptes* f. *brunnea* HARM. Lich. France
(1909) p. 636.

Exsic. NORRL. et NYL. Herb. Lich. Fenn. 214. (*Ph. muscigena* Ach.
var. *semifarrea* WAIN.). CLAUD. et HARM. Lich. Gall. 494 (s. n. *Physcia pul-
verulenta* var. *leucoleiptes* f. *brunnea* HARM.). FRIES Lich. Suec. 294. (*Parm.
pityrea farrea*).

¹ Lich. Univ. p. 475.

² Lich. France p. 636.

Laciniae with ascending margin or entirely ascending to erect. They are short, at their apices widened like a fan, rounded and coarsely crenate or irregularly, frequently deeply, incise. Laciniae sorediate along their whole margin, old laciniae sometimes incurved and therefore apparently covered with soredia; soredia white or yellowish. Thallus greyish-brown, brown or (from the pruina) bluish-violet, laciniae at their apices or entirely covered with a pruina of varying colour: white, pale blue or bluish-violet. Lower side pale or even white at the circumference and on the ascending laciniae, otherwise black. Rhizinae of the same colour as the lower side.

Apothecia and pycnides not seen.

This variety is certainly rare in Norway. It is recorded from our northernmost province Finmarken: Østerbotten at the inland end of the Porsanger fjord on mossy rocks near the sea. — These specimens are coarser than those of NORRL. and NYL. and — owing to the pruina — the colour is more bluish-violet instead of brown; but otherwise there is full conformity. — I also refer some specimens from Leangen in Asker near Kristiania to this variety (on mossy old stones). The laciniae are broader and less ascending (more conformable to FRIES Lich. Suec. No. 204 and to CLAUD. et HARM. No. 494), but corticolous specimens often have less ascending laciniae than muscicolous ones.

The plant of CLAUDEL and HARMAND is more delicate than ours, and the laciniae more panniform.

10. *Physcia obscura* (EHRH.) NYL.

Lichen obscurus EHRHART Plantae cryptogamae (1791) no. 177.

Lichen orbicularis HOFFMANN Enumeratio (1784) p. 68, tab. IX, fig. 1 et *Lichen ciliatus* l. c. p. 69, tab. XIV, fig. 1.

Lichen ulothrix et *L. cyclozelis* ACHARIUS Prodomus (1798) p. 113.

Parmelia ulothrix et *P. cyclozelis* α ACHARIUS Lich. Univ. (1810) p. 481—482 (ubi syn.).

Physcia obscura α *orbicularis* et β *ulothrix* TH. FRIES Lich. Arct. (1860) p. 65.

Physcia obscura et var. *ulothrix* NYLANDER Lich. Scand. (1861) p. 112. HUE Lich. Extra-Eur. (1900) suite 1, p. 70.

Physcia obscura α *orbicularis* TH. FRIES Lich. Scand. I (1871) p. 142.

Physcia obscura et *Ph. ulothrix* CROMBIE Brit. Lich. I (1894) p. 318 et 319.

Physcia orbicularis DALLA TORRE et SARNTHEIM Die Flechten von Tirol (1902) p. 165.

Physcia obscura f. *chloantha* et var. *cycloselis* et var. *ulothrix* HARMAND Lich. France (1909) p. 643 et 646.

EXSIC. ANZI Lich. Ital. sup. 124 (*Parm. obscura* var. *chloantha* (ACH.)). 127 (*Parm. obscura* f. *ulothrix* (ACH.)). FUNCK Crypt. Gew. 498 (*Parm. ulothrix* ACH.)). HEPP Flecht. Eur. 596 (*Lobaria obscura* α *chloantha* (ACH.)), 597 (*L. obsc.* ϵ *cycloselis* α *corticola*). MALME Lich. Suec. 309 (*Ph. obscura* (EHRH.) NYL. var. *ciliata* (HOFFM.) WAIN.). SCHAEERER Lich. Helv. 353 p. p. (*Parm. obscura* α *chloantha*), 354 p. p. (*Parm. obscura* γ *orbicularis* SCHAEER.). SOMMERFELT Plant. Crypt. Norv. 68 (*Parm. cycloselis* ACH.). STENHAMMAR Lich. Suec. 211 (*Parm. obscura* FR.). TUCKERMAN Lich. Amer. Sept. 87 (*Parm. obscura* β *ulothrix* FR.). ZAHLBRUCKNER Krypt. Exsic. Vindob. 577 (*Ph. obscura* var. *chloantha* NYL.).

Thallus growing in small or middle-sized rosettes, diam. 4–5 cm., appressed or closely appressed to the substratum. Laciniae distinctly stellate, linear, equally broad, 0.5–1 mm. broad, 4–5, rarely up to 10 mm. long, truncate or rounded at the apices, repeatedly — usually divaricately — furcate or multifid. Laciniae discrete or occasionally with somewhat imbricate margins, plane or slightly convex with a smooth surface, without soredia or isidia, opaque, epruinose, at the margin with pale stellate cilia. Colour greyish-brown or dark-brown, lower side black. A cushion of long, highly interlaced, tomentose, usually unbranched rhizinae is seen between the discrete laciniae.

Thallus covered with a thin amorphous, uncoloured stratum. Upper cortex 25–45 (55) μ thick, at the exterior part yellowish or greyish-brown, otherwise uncoloured. Hyphae regular, perpendicular to the surface, constrictedly septate, almost moniliform, cell wall thin or moderately incrassate. Gonidia glomerate, disposed in a somewhat incontinuous stratum under the upper cortex, more rarely in the whole medulla. Medulla white, lower cortex black, 25–40 μ thick, rhizinae ca. 40 μ thick.

Nearly always fertile; apothecia appressed, crowded, orbicular with diam. 1.5–2.5 mm., or angular, due to mutual pressure. Margin of middle thickness, persistent, entire or crenate. Receptacle smooth or rugulose, along the margin of the same colour as the thallus, otherwise black, on the lower side and at the margin with black rhizinae,

varying from short and scattered to very numerous and conspicuous, radiating like a corona, and very rarely failing. Cortex 25—50 μ thick, formed of thick-walled, constrictedly septate hyphae, perpendicular to the surface. Gonidia crowded in irregular clusters within the margin of the receptacle, scattered in the medulla and under the hypothecium, few or absent within the black part of the cortex. Hypothecium formed of thick-walled plectenchymatous hyphae, uncoloured, up to 55 μ thick. Disc brownish or black, moistened persistently brownish black, plane or slightly convex, epruinose. Hymenium covered with an amorphous uncoloured stratum; 80—110 μ thick, at the exterior part yellowish-brown to dark brown, otherwise uncoloured, not insperse. Paraphyses at their tips clavately incrassate and distinctly constrictedly septate, unbranched or with a few short lateral branches near their apices. Asci 60—75 μ long, 16—26 μ thick, octosporous. Spores obliquely biserial, straight, ellipsoid, not constricted at the septum, but occasionally flattened on one side, the radius of one contour being shorter than that of the opposite. Colour greyish-brown, old spores almost opaque. Cell rooms angular, stretched across the spore or sometimes resembling a sand-glass. Septum thick. Spores at least twice as long as thick, size 20—25 μ long, 9,3—12 μ thick.

Pycnides numerous, especially towards the apices of the laciniae, globose or with a slightly protrudent ostium. Perifulcrum dark around the ostium, otherwise uncoloured. Pycnoconidia straight, elliptical, small: 2—3 μ long, 1—1,5 μ thick.

React. Neither cortex nor medulla coloured by KOH or CaCl_2O_2 . Hymenium blue, then at once vinous-red or brownish-red by J.

Hab. On the bark of deciduous trees, especially on *Populus tremula*, very rarely on *Betula*. Norwegian saxicolous specimens not recorded.

Loc. Frequent or even abundant in Southern Norway, recorded as far north as Skoganvarre in Finmarken, but it is rare in Northern Norway. It is most frequent in the lowlands, but it ascends as high as *Populus tremula* (as a tree), in Eastern Norway to about 800 m., in Western Norway to 400—500, rarely to 600 m. above the sea level. On the whole, *Physcia obscura* has about the same distribution in Norway as *Populus tremula*.

Abundant near Kristiania from numerous stations in Aker (MOE), Bærum and Asker (LYNGE), abundant in the south-eastern lowlands: Aarnes (HOCH), Rena (KLÆR), Minne (LYNGE), Veldre (NORDHAGEN), Lillehammer (JEBE), Vaage (NORMAN), Dovre (ZETTERSTEDT), Norderhov (NORMAN), Brandbu

(LYNGE), Land and Vang (NORMAN), Hol (LYNGE). Evidently frequent along the south and west coast and fjords: Larvik (NORMAN), Granvin and Romsdalen (HAVAAS). Also at Voss (LID) and Mjølfjell (LYNGE) in Western Norway. Trondhjem: Strinden (KINDT). In Northern Norway: Saltdalen (SOMMERFELT), Kautokeino (NORMAN) and Skoganvarre (LYNGE).

f. *orbicularis* (HOFFM.).

Lichen orbicularis HOFFMANN Enumeratio (1784) p. 68, tab. IX, fig. 1.

Apothecia without a corona of conspicuous rhizinae, rhizinose only on the under side of the receptacle, rhizinae of the receptacle few or (very rarely in Norwegian specimens) entirely wanting.

f. *ciliata* (HOFFM.).

Lichen ciliatus HOFFMANN Enumeratio (1784) p. 68, tab. XIV, fig. 1.

Lichen, *Parmelia*, *Physcia ulothrix* autorum.

Apothecia with a crown of conspicuous spreading rhizinae.

From HOFFMANN's description it is probable that his *Lichen orbicularis* comprises our forms as well as *Physcia virella*: »foliolis margine verrucosis pulverulentis«, . . . »polline, in humido ex viridi flavescens«. His excellent figure is, however, entirely our f. *orbicularis*.

The »type« of f. *ciliata* has apothecia with a crown of conspicuous stellate, spreading rhizinae. In other apothecia the rhizinae are less numerous, scattered under the receptacle, and for that reason only visible when the lower side of a loosened apothecium is observed through the lens or on a thick section. I have examined the apothecia of more than 100 herbarium specimens, and innumerable plants in nature, only finding a few entirely devoid of rhizinae. There is every intermediate state between »no rhizinae« and the typical »corona«. — The colour varies from pale ash-grey to dark greyish-brown. The variation of the colour has no correlation whatever with the development of the rhizinae.

ACHARIUS separated his »*Lichen ulothrix*« from »*Lichen cyclosclis*« on account of the rhizinose apothecia of the former species (cfr. Lich. Univ. p. 482). Later authors have followed him, some of them regarding the two as different species, others as two varieties. For the reasons given above, I am only able to look upon them as forms of individual variation.

In our herbarium there are some plants of this tribus which have rather elongate, appressed laciniae, with a few lateral soredia and much the habitus of our *Ph. obscura*. On the other side they approach quite as near to plants which undoubtedly belong to *Ph. virella*. Authors disagree as to the question whether *Ph. obscura* is or is not sorediate. I agree with CROMBIE, describing *Ph. obscura* (and his *Ph. ulothrix*) as esorediate¹, I have accordingly referred the above mentioned plants to *Ph. virella* (juvenile specimens).

Some authors have described a f. *chloantha* SCHAEER. with pale thallus, and reserved the name *cycloselis* for darker coloured plants. These »forms« occur in Norway, the latter most frequently, but they are insignificant and hardly worthy of a name.

11. *Physcia virella* (ACH.).

Lichen virellus ACHARIUS Prodrumus (1798) p. 108.

Parmelia virella ACHARIUS Methodus (1803) p. 201.

Lecanora virella ACHARIUS Lich. Univ. (1810) p. 414. ACHARIUS Synopsis (1814) p. 191.

Parmelia (*Lichen*) *cycloselis* b. *virella* SOMMERFELT Supplem. Florae Lappon. (1826) p. 109.

Parmelia obscura η *leprosa* SCHAEERER Enumeratio Critica (1850) p. 38.

Anaptychia obscura x *nigricans* MASSALONGO Memorie Lichenographiche (1855) p. 58.

Rinodina virella KOERBER Syst. Lich. Germ. (1855) p. 124.

Rinodina leprosa (SCHAEER.) MASS. KOERBER Parerga Lichenol. (1865) p. 72.

Parmelia obscura var. *virella* TH. FRIES Lich. Arctoi (1860) p. 65. NYLANDER Lich. Scand. (1861) p. 112. TH. FRIES Lich. Scand. I (1871) p. 142. LEIGHTON Lich. Flora Great Brit. (1879) p. 137. OLIVIER Étude sur les . . . *Physcia* etc. (1894) p. 90. OLIVIER Lichens d'Eur. I (1907) p. 244. HARMAND Lichens de France (1909) p. 645. LYNGE Blad. og busk-laver Berg. Mus. Aarb. 1910, no. 9, p. 101.

Physcia ulothrix var. *virella* CROMBIE Brit. Lich. I (1894) p. 320.

Physcia orbicularis (NECK.) TH. FR. c. *virella* DALLA TORRE et SARNTHEIM Die Flechten von Tirol (1902) p. 166.

¹ CROMBIE Brit. Lich. I, p. 318—319.

KOERBER is of the opinion that the »*Lecanora virella*» of ACHARIUS Synopsis p. 191 is not our plant¹, but he gives no arguments. The descriptions of ACHARIUS quoted agree perfectly with our plant, and TH. FRIES, who has seen the ACHARIAN herb., unhesitatingly accepts the ACHARIAN name.

I have never seen the combination »*Physcia virella*« used in literature. It has been employed in the case of two exsiccates: MALME 158 (anno 1910), and MERESCHKOWSKY 71, 72 (anno 1913).

Exsic. ANZI Lich. Ital. sup. 126 (*Parm. obscura* var. *virella*) ANZI Lang. 293 (*Parm. obscura* var. *orbicularis* (NECK) SCHAEER.). ARNOLD Lich. Exs. 1368 (*Ph. obscura* var. *virella*). CLAUD. et HARM. Lich. Gall. praec. 180 (*Ph. obscura* var. *ulothrix*), 181 (*Ph. obscura* var. *virella*), 379 (*Ph. obscura* var. *cyclozelis* SCHAEER., rhizomorph receptacle). FLOERKE Deutsche Lichenen 94 (*Parm. ulothrix* ACH.). FRIES Lich. Suec. 205 (p. p. s. n. *P. cyclozelis*). HEPP Flecht. Eur. 55 (*Lobaria obscura* η *leprosa*, almost crustaceous specimen), 599 supr. inf. (*Lob. obscura* η *virella*). MALME Lich. Suec. 158. MASSALONGO Lich. Ital. 247 (*Squamaria obscura* var. *nigricans* MASS.). MERESCHKOWSKY Lich. Ross 71, 72. NORRL. et NYL. Herb. Lich. Fenn. 221 (*Ph. ulothrix* var. *sorediosa* NYL.), 222 (*Ph. ulothrix* (ACH.) NYL.). RABENHORST Lich. Eur. 438 (*Rinodina virella*). SCHAEERER Lich. Helv. 355 (*Parm. obscura* ϵ *cyclozelis* SCHAEER.), 607 sin. (*Parm. obscura* ξ *virella* SCHAEER.).

Thallus orbicular, small, diam. 1—1.5 cm., but inclined to grow in dense clusters covering larger areas, especially on moist rocks; on even substratum slightly appressed, sometimes almost crustaceous, on uneven more or less spreading or subascendant. Laciniae very short (2—3 mm.), initial laciniae stellate and contiguous, later they become imbricate; they are plane or slightly convex, repeatedly deeply incise with crenate branches. Longitudinal growth quickly checked by apical soredia, sometimes spreading over the whole thallus. Soredia greyish-white, greyish green or occasionally yellowish. Thallus without isidia, opaque, grey or greyish-green, greyish-brown or even dark brown, rarely greyish-white, moistened distinctly green, lower side black, rarely pale or even white at the circumference. Young laciniae with small stellate white cilia at the margin. Rhizinae short, black, usually unbranched, 25—40 μ thick.

¹ Parerga Lichenologica p. 72.

Thallus usually covered by an amorphous uncoloured stratum. Upper cortex up to $40\ \mu$ thick, cortical hyphae distinct, perpendicular to the surface, constrictedly septate, thin-walled with great lumina. Gonidia arranged in a thick irregular, continuous stratum under, occasionally in the cortex. Medulla white. Lower cortex black, $25\text{--}50\ \mu$ thick.

Most frequently sterile, but fertile plants are not rare. Apothecia orbicular, small, diam. $1\text{--}1.5\text{--}(2)$ mm., sessile, loosely affixed. Margin prominent, thick, persistent, entire or crenate, esorediate. Receptacle even or minutely rugose, black around the centre, of the same colour as the thallus towards the circumference, usually without, but occasionally with rhizinae. Cortex $25\text{--}50\ \mu$ thick, its hyphae perpendicular to the surface, thick-walled, constrictedly septate. Gonidia in dense clusters in the margin, and scattered in the whole medulla, especially within the uncoloured parts of the cortex and under the hypothecium, few or entirely absent within the black cortex. Hypothecium up to $55\ \mu$ thick, almost uncoloured, formed of thick-walled densely interlaced plectenchymatous hyphae, arranged tangentially to the hymenium. Disc reddish-brown, plane, epruinose. Hymenium covered with an uncoloured amorphous stratum, which occasionally breaks up into an insperse mass. Hymenium to $105\ \mu$ thick, yellowish-brown at the exterior part, otherwise uncoloured and not insperse. Paraphyses at their tips clavately incrassate, distinctly constrictedly septate, occasionally with some short branches. Asci $52\text{--}65\ \mu$ long, $13\text{--}18\ \mu$ thick, octosporous. Spores obliquely biserial, straight, typically ellipsoidal: not constricted at the septum, rounded at their apices and at least twice as long as they are thick. Colour greyish-brown, old spores almost opaque. Spores with distinct pore canal, septum thick, cell rooms angular, stretched across of the spores, or rounded like a sand-glass. Size $(14\text{--})17\text{--}25\ \mu$ long, $(7\text{--})8\text{--}12\ \mu$ thick.

Pycnides frequent, but rapidly destroyed by the expanding soredia. They protrude slightly at the ostiolum, and are subglobose, diam. $160\text{--}240\ \mu$. Perifulcrum brownish around the ostiolum, otherwise uncoloured. Pycnides straight, broadly fusiform or subelliptical, $2\text{--}4\ \mu$ long, $1\text{--}2\ \mu$ thick.

React. Neither cortex nor medulla coloured by KOH or CaCl_2O_2 . Hymenium first blue, then at once vinous red by J.

Hab. On the trunks of deciduous trees (not on *Betula*), and on moist rocks, especially schistose and calcareous. North of Salten only recorded on chalk.

Loc. *Physcia virella* is a lowland species, frequent or even abundant at least as far north as Trondhjem, probably with the exception of our

great south-eastern valleys. Northern limit Ibbestad and Malangen in Tromsø amt.

Abundant about Kristiania: Tøien, Akershus (BLYTT), Næsodden (MOE), Aker, Bærum and Asker (LYNGE; at Leangen on chalk), Haaøen (BLYTT), Drammen (KJÆR), Hakedalen (LYNGE), Minne (also on stone, LYNGE), Modum (MOE), Ringerike: Sundvolden (HAVAAS), Brandbu and Vestfjorddalen (LYNGE), Toten, Ringebru and Vaage (SOMMERFELT), Drivstuen on Dovre (LYNGE). Abundant along the south and west coast, on trees and stone: Larvik (NORMAN), Lyngør (LYNGE) Moster and Granvin (HAVAAS and LYNGE). Voss: Bjørgum, Vangen and Graasiden (LYNGE). Abundant about Trondhjem: Sorgenfri (LYNGE), Frosta (JØRSTAD). Salten: (SOMMERFELT), Steigen (NORMAN). North of Lofoten it is evidently rare, recorded only from maritime chalky rocks at Havnvik in Ibbestad and Nordbyneset in Malangen (LYNGE).

The thallus is sometimes suffused with small yellow patches, coloured violet by KOH, when growing associated with *Xanthoria parietina*. This is due to chrysophanic acid, produced by the said Lichen. Such »forms« are entirely incidental and not entitled to a proper name (f. *flavescens* CROMBIE Brit. Lich. I, p. 320).

Very convex laciniae are occasionally found. We might expect to find pycnides in them, but they are due to a strong growth of the gonidia, accompanied by a corresponding growth of the cortex, which is not — as usual — broken up and soredia formed.

Great importance has been attributed to the black colour of the lower side. It is, indeed, a remarkable, but in my opinion no decisive character. Though not frequently, I have found *Ph. virella* with a pale lower face, especially at the circumference. — Owing to the contiguous or imbricate laciniae the black rhizines are but slightly visible.

In one apothecium I found 6-celled spores of a very varying size: $21-39 \times 9,2-13,5 \mu$. — The spores of *Ph. virella* are somewhat smaller than in *Ph. obscura*. On the whole the structure of the organs of fructification agrees well in the two species. They have been treated here as two species, owing to the difference of the morphological characters. Different colour and habitus, longer and more appressed laciniae in *Ph. obscura* and the never absent rhizines on the receptacle of *Ph. obscura*. The two species were separated as proper species by ACHARIUS in his Prodomus as early as in 1798, later authors have often confounded them, neglecting external characters and only acknowledging carpological characters as important.

Physcia virella is a very variable plant. The soredia are frequently yellow as in f. *Hueana* HARM. Catal. Lich. Lorr. p. 235, but I have never seen the »corpuscules plus ou moins écarlats« described by HARMAND in his form. — The soredia are at first small and well limited, later confluent. Well grown specimens often show juvenile states of soredia, a frequently occurring phenomenon with many characters of the Lichens. — The colour of the thallus varies from pale greyish through pale brownish to dark brown or even brownish-black. — Rhizinae are occasionally found on the lower side of the apothecium. — Plants with a brownish colour and rhizino-receptacle might probably as well be referred to *Ph. obscura* as a var. *sorediosa*. But that involves an artificial and arbitrary limitation of the species, for there are numerous intermediate states of colour and of receptacles without rhizinae and receptacles with many rhizinae, although the latter are rare. I prefer to use the soredia as a decisive character. *Physcia obscura* without soredia, *Ph. virella* with soredia. The consequence of this would be to propose a f. *ciliata* of *Ph. virella* as well as of *Ph. obscura*, but it is not necessary, for I have not seen conspicuously crowned apothecia in Norwegian *Physcia virella*.

12. *Physcia lithotea* (ACH.) NYL.

Parmelia cyclozelis var. *lithotea* ACHARIUS Methodus (1803) p. 199. ACHARIUS Lich. Univ. (1810) p. 483.

Physcia obscura α *orbicularis* f. *lithotea* TH. FRIES Lich. Scand. I (1871) p. 143.

Physcia obscura f. *lithotea* WAINIO Adjumenta I (1881) p. 133. LYNGE Blad- og busklaver. Berg. Mus. Aarb. 1910, no. 9, p. 101.

Physcia lithotea NYLANDER De gonidiis etc. Flora 1877 p. 354. CROMBIE Brit. Lich. I (1894) p. 318. DALLA TORRE et SARNTHEIM Die Flechten von Tirol (1902) p. 167. OLIVIER Lichens d'Europe I (1907) p. 244 (168). HARMAND Lichens de France (1909) p. 647.

Physcia lithotea was recognized as a proper species for the first time by NYLANDER l. c. NYLANDER's statement: »*Physcia lithotea*, quae species separanda est a *Physcia obscura*, texturam thalli aliam habente« is almost a nomen nudum. The first author to give a full description of *Ph. lithotea* as a proper species, was CROMBIE.

Exsic. ANZI Lich. Ital. sup. 128 (f. *sciastra*, approaching to f. *nuda*, s. n. *Parmelia obscura* var. *sciastra* (ACH)). ARNOLD Lich. exsic. 826,

1369 (s. n. *Parmelia obscura* var. *lithotea* ACH.). MIGULA Krypt. Germ. 931 (f. *sciastra* s. n. *Physcia obscura* (EHRH.) NYL. f. *orbicularis* (NECK.) TH. FR.). NORRL. et NYL. Herb. Lich. Fenn. 220 (f. *sciastra*, s. n. *Ph. lithotea* (ACH.) NYL.).

Thallus small or middle-sized, orbicular, 2—4 cm. in diam., but inclined to grow in dense clusters, covering larger areas; on plane substratum closely appressed, on uneven (e. g. moss) at the circumference more or less free from the substratum or even slightly ascendant. Laciniae stellate, elongate, narrow: 0,2—0,5, rarely up to 0,8—1 mm. broad, closely contiguous or imbricate, towards the centre always imbricate. Laciniae very multifid, either pinnato-incise or furcate, with acute angles; long branches with straight or slightly undulate outlines, subsascent laciniae usually shorter and broader with more or less undulate margin. Thallus without soredia, but at the margin of the laciniae and at the ends of the short lateral branches are formed short furfuraceous or more elongate, branched isidia. Towards the centre the isidia frequently spread over the whole thallus and become confluent. Thalli without isidia are occasionally found (young thalli?). If the cortex of the isidia is broken off, they occasionally develop soredia-like forms (isidia sorediose fatiscientia). Thallus fragile, opaque, epruinose, laciniae plane or sometimes with slightly ascendant margin. The colour varies from grey or pale greyish-brown through greyish-black to black, lower side always black, even on ascendant laciniae. Laciniae with long pale cilia or rhizinae at the margin, the rhizinae of the lower side are black, only slightly visible — owing to the closely contiguous laciniae —, very branched, thick: to 120 μ at their base.

Thallus covered with a thin, amorphous, finally insperse stratum, upper cortex at the exterior part more or less dark greyish-brown, otherwise uncoloured. Hyphae perpendicular to the surface, thin-walled, constrictedly septate with rounded articuli. Isidia distinctly corticate. Upper cortex of an irregular thickness (to 25 μ), on account of the uneven surface of the gonidia, gonidia also occasionally filling out the whole thin white medulla. Thallus thin, rarely more than 200 μ thick.

Thallus usually fertile; apothecia sessile to closely appressed, middle-sized, 1, rarely 2 or 2,5 mm. in diam. Margin persistent, entire or crenate, sometimes shortly appendiculate. Receptacle black around the centre, uncoloured towards the margin, with scattered black rhizinae on the lower side. The hyphae of the cortex perpendicular to the surface, middle thick-walled, constrictedly septate with rounded articuli. Gonidia crowded within the unco-

loured part of the cortex, especially in the margin of the apothecia, scattered under the hypothecium only, and absent within the black part of the cortex. Hypothecium yellowish, thick: up to $105\ \mu$, hyphae with narrow lumina, densely interlaced. Disc plane or slightly convex, brownish-black or black, epruinose, covered with a thin amorphous uncoloured stratum. Hymenium at the exterior part pale or dark yellowish-brown, otherwise uncoloured. Paraphyses distinctly septate, unbranched or occasionally furcate, at their apices clavato- or capitato-incrassate and constrictedly septate. Asci $80-85\ \mu$ long, $13-16\ \mu$ thick, octosporous. Spores obliquely biserial or parallel to the axis of the ascus, straight, rarely slightly fabiform, not constricted at the septum, with rounded ends. Colour greyish-brown to black, old spores very opaque. Cell room usually small and angular, stretched across the thick-walled spore, occasionally large and rounded, leaving only a relatively thin cell-wall. Porous canal distinct.



Fig. 8. *Physcia lithotea*
(Ach.) Nyl.

Spores ellipsoidal, their thickness about half the length or a little longer, size $15.7-22(24)\ \mu$ long, $7.4-11(13)\ \mu$ thick.

Pycnides globose or with a slightly prominent upper part; perifulcrum and the adjacent parts of the cortex dark or black about the ostiolum, otherwise the perifulcrum is uncoloured. Pycnoconidia ellipsoidal, $2.5-4\ \mu$ long, $1.2-1.8\ \mu$ thick.

React. Neither cortex nor medulla coloured by KOH or CaCl_2O_3 . Hymenium first blue, then dark vinous-red or almost black by J.

f. *nuda* n. f. ad int.

Thallus isidiis destitutus.

f. *sciastra* (Ach.) CROMB.

Parmelia sciastra ACHARIUS Methodus Supplementum (1803) p. 49. ACHARIUS Lich Univ. (1810) p. 471.

Lichen fahlunensis β *sciastrus* WAHLENBERG Flora Lapponica (1812) p. 428.

Physcia obscura var. *sciastra* NYLANDER Lich. Scand. (1861) p. 112. NYLANDER Synopsis (1858-60) p. 428. WAINIO Adjumenta I (1881) p. 133.

Physcia lithotea var. *sciastra* CROMBIE Brit. Lich. I (1894) p. 319. DALLA TORRE et SARNTHEIM Die Flechten von Tirol &c (1902) p. 168.

OLIVIER Lichens d'Europe I (1907) p. 244 (168). HARMAND Lichens de France (1909) p. 648.

Thallus isidiate only at the margin of the laciniae. Otherwise as in the type

f. *typica* (*lithotea*).

Thallus, at least towards the centre, isidiate on the surface of the laciniae as well as at the margins.

Hab. *Physcia lithotea* prefers depressions of rocks which are frequently moistened by the sea and by lakes and streams in maritime and mountainous districts and on mosses which are frequently irrigated. — It has never been recorded from wood or bark in Norway.

Loc. There are few Lichens, which have a wider distribution in our country. It is quite as frequent in Southern as in Northern Norway, on chalk, schistose and hard rocks. Its vertical distribution is less known. At Drøbak in the Kristiania-fjord it grows luxuriantly by the shore, sprinkled by the sea water, and in Tromsø Amt it is a typical plant of maritime rocks. It is recorded from Drivstuen and Kongsvold on Dovre (900 m. s. m.), Finsehøgen (1550 m.), in Western Norway it ascends to the snow limit, in Northern Norway it is recorded from Altevand (500 m. s. m.), and it will probably be found on the little investigated high mountains in Northern Norway. — There is no difference as to the distribution of the different forms, which grow together.

Abundant near Kristiania, and recorded from numerous stations in Aker, Bærum, and Asker. Frequent in the south-eastern lowlands: Lillestrømmen (MOE) Minne (LYNGE), Ringeby (SOMMERFELT), Hadeland (LYNGE). Frequent in the great south-eastern valleys: Tønset and Fæmunden (LYNGE), Hunder (HAVAAS), Vaage (TH. FRIES), Lom (LYNGE), Listad in Øvrebygden (F. KLÆR), Hol (LYNGE); also on the central mountains: Dovre (BLYTT), and Finse (LYNGE). Frequent along the south and west coast: Drøbak and Lyngør (LYNGE), Moster, Granvin, Eidsfjord and Sundal (HAVAAS). Nordland: Alstahaug (BLYTT), Saltdalen (SOMMERFELT), and Melbo (NORMAN). Tromsø amt: Harstad (NORMAN), Ibbestad, Sørreisen, Gibostad, Malangen, Vikran, (LYNGE), Tromsø (NORMAN); abundant in the valleys: Maalselven, Bardo, and Skibotndalen everywhere from the coast to the mountains

(LYNGE). Finmarken: Konsamfjeld (WAHLENBERG) and Talvik (BAUR) in Alten; Honningsvaag, Østerbotn, Lakselv, and Skoganvarre (LYNGE) in Porsanger; Vadso (HAVAAS); Næsseby (TH. FRIES), and Sjaaholmen (TH. FRIES) in Varanger.

It is only to be expected that a plant of this frequency and wide distribution should be a variable species. A part of the variation is directly due to the substratum, e. g. the elongate, stellate laciniae of plants, growing on flat slates, and the more irregular, shorter, broader, and more imbricate, at the circumference more or less free laciniae of plants, growing on rugged granite, or on mosses (f. *muscicola* SCHAEER.).

In some plants the isidia are absent, in others developed at the margin of the laciniae (f. *sciastra*), or — about the centre — also on their surface, more rarely over the whole thallus, entirely covering the laciniae. It is evident that isidiate plants commenced their existence without isidia, and undoubtedly many of the »nuda« or »sciastra« plants develop into more isidiate stages; in that case they only represent different stages of age. On the other hand I have seen numerous full-grown plants showing little tendency to form isidia. It is, accordingly, very questionable whether we should regard them as stages of individual development, or as types of variation. Anyhow it is quite impossible to divide *Ph. lithotea* into well limited varieties after the isidia, for there are all intermediate states between a naked thallus and a thallus, entirely covered with isidia.

Occasionally the thallus has a tinge of bluish-violet, which calls to mind pruinose forms of *Ph. muscigena*. I have, however, never seen pruina in *Ph. lithotea*. — The colour is to some degree dependent on the insolation: dark in strong insolation, pale in plants growing in the shade. This is distinctly seen on plants growing over sharp edges into shadowed positions.

The upper cortex is thinner than in *Ph. obscura*, and the hyphae more thin-walled; in both species they are constrictedly septate, almost moniliform.

In some foreign floras¹ apothecia are reported to be rare, in Norway fertile plants are very frequent. The greatest, especially the broadest spores have been measured in muscicolous plants, but a statistical grouping of the dimensions only gives a »one-topped« curve, indicating one type. — The anatomical investigation of thallus and apothecia gives no basis for the division up of *Ph. lithotea*. — In every section there are

¹ CROMBIE Brit. Lichens I p. 319.

seen many shrunk, undeveloped spores, in many apothecia there are only such spores. — The rhizines of the receptacle are rarely wanting, in some thalli they are so well developed as to form a veritable corona around the apothecia (as in *Ph. obscura* f. *ciliata*).

The pycnides are easily overlooked in dark thalli; they are evidently not very frequent.

I have seen authentic specimens of the »*Ph. obscura* var. *mutabilis*« NILSS. = var. *orbicularis* et *virella* TH. FRIES, which in my opinion is only a slightly developed *Ph. lithotea* f. *sciastra*.

var. *lithotodes* (NYL.) LYNGE comb. nov.

Physcia lithotodes NYLANDER Addenda nova. Flora 1875 p. 360.
OLIVIER Lichens d'Europe I (1907) p. 245 (169).

Physcia obscura var. *lithotodes* WAINIO Adjumenta I (1881) p. 133.

Thallus orbicular, up to 6 cm. in diam., loosely appressed to the substratum. Habitus placodium-like: Laciniae at the circumference stellate, closely contiguous or more or less imbricate, towards the centre indistinct, almost crustaceous. Laciniae 0,3—1 mm. broad, repeatedly palmato-incise or furcate, rounded at their apices, with undulate contours. They are slightly convex, esorediate, without isidia or with some scattered short isidia at the margin, at the apices and at the margin with deciduous, spreading, pale cilia, opaque, epruinose. Colour pale or dark grey, moistened greenish, lower side pale at the circumference, otherwise black. Rhizinae dark or even black, thick: 100—110 μ .

No amorphous stratum over the thallus. Upper cortex thin, 8—15 μ thick, at the exterior part dark, otherwise uncoloured. Hyphae moniliform, occasionally growing out over the surface as hair-like emergences. Gonidia disposed in a continuous stratum under the cortex, sometimes filling up the whole medulla. Lower cortex 25—30 μ thick.

Apothecia very numerous, covering the whole central part of the thallus, orbicular or angular, 1—2 (2,5) mm. in diam. Gonidia densely crowded in the margin and under the hypothecium, more scattered within the cortex of the receptacle. Spores 15,7—23,7 μ long, 9,2—11 μ thick (vide infra), on an average slightly broader than in *Ph. lithotea*. The other parts of the apothecia as in *Ph. lithotea*.

¹ Die Flechten, in Untersuch. des Sarekgebirges; vol. III, p. 49.
Vid.-Selsk. Skrifter. I. M.-N. Kl. 1916. No. 8.

Pycnides numerous, but fertile ones were searched after in vain.
React. as in *Ph. lithotea*.

Hab. and loc. Only recorded from one Norwegian station: Høgskarhus in Dividalen, inner part of the Tromsø district in Northern Norway, growing on large flat stones on the banks of the river, submerged at flood-tide.

The scarcity of my material has prevented me from making any observations as to its variability. The late and much regretted Finnish lichenologist, Mr. LÅNG, sent me some specimens from Finnish and Swedish Lapland; according to Mr. LÅNG it should be frequent there. His plants agree well with the Norwegian ones, but they have narrower laciniae. In one of them the lower part of the medulla was locally coloured yellowish red (purple by KOH).

There is a margo proprius round the hymenium, but I have not been able to find the »margo thallinus« described by NYLANDER in Flora 1875, p. 360. — NYLANDER measured longer and narrower spores: $17-23 \times 6-9 \mu$.

Separated from *Physcia lithotea* by the paler colour (?) which seems to be normal in var. *lithotodes*, by convex laciniae and by the placodium-like thallus. The upper cortex is thinner than in *Ph. lithotea* and the green colour more visible in moistened plants. The disposition to form isidia is very weak, but not quite absent. Initiating *sciastra*-like isidia are found in the Finnish as well as in the Norwegian plants.

It is possible that a rich material would contain intermediate forms between var. *lithotodes* and the naked forms of *Ph. lithotea*; in that case var. *lithotodes* would be reduced to a mere individual variation. But Mr. LÅNG who studied it in nature and whose opinions were worthy of the greatest attention, considered it to be a good variety, perhaps even a proper species. — Its geographical distribution also seems to be well limited: The continental parts of Northern Fennoscandia.

13. *Physcia tremulicola* NYL.

Physcia tremulicola NYLANDER Addenda Nova XVII Flora (1874) p. 7.
OLIVIER Lich. d'Europe I (1907) p. (169) 245.

EXSIC. HAVAAS Lich. Norv. (inedit). NORRL. et NYL. Herb. Lich. Fenn. 217.

Thallus growing in small rosettes, diam. 1—1,5 cm. Laciniae narrowly filiform, 0,05—0,15 (0,2) mm. broad, distinctly flattened, with an irregular, undulate or even crenate margin, very multifid, either pinnate or divaricately furcate, greatly entangled in each other. In young plants they are appressed to the substratum and (indistinctly) stellate, later they become imbricate and more or less ascending or even erect at the centre, old thalli pulvinate. Thallus very fragile, surface minutely scabrose (strong lens), opaque, moistened translucent, at the margin of the old laciniae with short, round, coralloid isidia of the same colour as the thallus. If the cortex of the isidia break off, marginal hyphae sometimes grow forth, forming small, inconspicuous, white »secondary soredia«.



Fig. 9.
Physcia tremulicola. Nyl.

Colour dark brownish to black, lower side and rhizinae originally pale, later the rhizinae and the adjacent parts of the cortex become darker or even black.

Upper cortex up to 20μ thick, formed of thin-walled, constrictedly septate hyphae (up to 8μ thick), perpendicular to the surface and sometimes growing forth as hair-like pellucid emergences. Cortex dark at the exterior part, otherwise uncoloured. Gonidia conglomerate, arranged in an irregular stratum under or in the cortex, sometimes at the very surface of the thallus. Medulla white.

Apothecia unknown, pycnides searched after but in vain.

React. Cortex and medulla uncoloured by KOH as well as by CaCl_2O_2 .

Hab. Recorded only from the bark of *Populus tremula*.

Loc. The »locus classicus« of the species is Dovre (ZETTERSTEDT). Otherwise it is only recorded from Vaage: Presteberget (HAVAAS), and from Hakedalen, near Kristiania, not far from the railway station. (HAVAAS and LYNGE). — It has been much searched after in our country and must be a rare species.

WAINIO described a new *Physcia*: *Ph. pterygioides*¹, evidently separated from *Ph. tremulicola* by the colour: »cinereus, subtus albidus«, *tremulicola* is — after NYL. l. c. — »olivaceo-fuscus, . . . subtus concolor«. The authentic specimen of *Ph. tremulicola* NYL. (herb. Ups.) is pale greyish-brown (faded?), under side uncoloured. I have not seen *Ph. pterygioides*.

¹ WAINIO: Lich. Viburg. Meddel. Soc. Fauna et Flora Fennica vol. II (1878) p. 53.

Physcia tremulicola is separated from *Ph. sciastrella* NYL. by its linear, very narrow laciniae, appressed to the substratum, at least at the circumference of the thallus.

There is a difference in colour between the plants from Dovre and Vaage on the one hand, and those from Hakedalen on the other. The former ones agree entirely with the authentic specimen of NYLANDER, and with NORRL. and NYL. Herb. Lich. Fenn. 217, the latter are black. We may describe them as follows:

f. *typica*.

Thallus olivaceo-fuscus, subtus concolor.

Recorded from Dovre (ZETTERSTEDT, the authentic specimen of NYLANDER, hb. mus. bot. Upsal.), Vaage: Presteberget (HAVAAS).

EXSIC. NORRL. et NYL. Herb. Lich. Fenn. No. 217.

f. *atra* n. f.

Thallus ater, subtus concolor.

Known from Hakedalen, near Kristiania, on old *Populus tremula*.

EXSIC. HAVAAS Lich. Norv. (inedited).

There is no other difference between the two forms, which perhaps only represent individual variation, or difference of age.

14. *Physcia endococcina* (KBR.) TH. FR.

Parmelia endococcina KOERBER Parerga (1865) p. 36.

Physcia endococcina TH. FRIES Nya Skandin. Lafarter. Bot. Not. (1866) p. 150. GLÜCK Morphol. der Flechtenspermog. Verh. Naturh. Mediz. Vereins zu Heidelberg vol. VI N. F. (1899) p. 147 (67) fig. 39, Tab. II, fig. 1.

Physcia obscura var. *endococcina* TH. FRIES Lich. Scand. I (1871) p. 143. NYLANDER De gonidiis etc. Flora (1877), p. 354. LEIGHTON Lichen-Flora (1879) p. 142. HAVAAS Floristiske undersøgelser. Berg. Mus. Aarb. (1897), no. III, p. 10. DALLA TORRE et SARNTHEIM Die Flechten von Tirol

(1902) p. 165. HAVAAS Beiträge zur Kenntnis der westnorw. Flechtenflora. Berg. Mus. Aarb. (1909), no. I, p. 12. OLIVIER Lichens d'Europe (1907) p. 245 (169).

Physcia lithotea f. *endococcina* HARMAND Lichens de France (1909) p. 648.

I have not seen *Ph. obscura* f. *endochrysea* NYL. and var. *subnigricans* MÜLL., cited by HARMAND l. c. as synonyms.

EXSIC. ARNOLD Lich. Exsic. 533 (non vidi), and 1612 (*Parmelia endococcina* KBR.). HARMAND Lich. Gall. rar. 102 (*Ph. lithotea* f. *endococcina* HARM.). LOJKA Lich. Regn. Hung. 19. MERRILL Lich. Exsic 129 (*Ph. obscura* var. *endococcina* (KBR.) TH. FR., on branches of willows, rather unlike Norwegian specimens). SCHAEERER Lich. Helv. 485 (*Parmelia obscura* & *cyclozelis* b. *saxicola*).

Thallus growing in small, later confluent rosettes, closely appressed to the substratum. Lacinae plane, distinctly stellate, pinnato-incise, and very multifid, with divaricate branches, contiguous or even imbricate, narrow (0,2 mm.) or broader (to 0,5—0,6 mm.), narrow lacinae equally broad, broader widened towards their apices. Thallus esorediate, usually without isidia or occasionally towards the centre with a few short, scattered and slightly conspicuous isidia. The colour varies from greyish-brown to almost black, when moistened almost unaltered. Lower side black.

Thallus covered with a thin amorphous stratum. Upper cortex (20) 25—40 μ thick, at the exterior part greyish with indistinct hyphae, at the interior part uncoloured with distinct hyphae; hyphae constrictedly septate. Gonidia glomerate, rarely found in the upper cortex. Medulla formed of densely interlaced hyphae, at the upper part uncoloured, at the lower part yellow-red (cinnabar). Lower cortex black, 20—25 μ thick, formed of constrictedly septate hyphae with spacious lumina. Rhizinae scattered, black, 50 μ thick.

Almost always fertile, apothecia small, 0,5—1 (1,5) mm. in diam., sessile or appressed. Margin middle-thick, first entire, then crenate or even shortly appendiculate. Receptacle rhizinose; cortex black at the centre, uncoloured towards the margin, cortical hyphae perpendicular to the surface, constrictedly septate, relatively thin-walled. Gonidia crowded in the margin of the apothecia, few and scattered under the hypothecium, almost absent within the black part of the cortex. Hypothecium plectenchymatous, 40—50 μ thick. Disc plane, epruinose, pale or dark brown or brownish-black. Hymenium covered with a thin uncoloured, amorphous,

later insperse stratum. Hymenium at the exterior part yellowish or yellowish-brown, otherwise uncoloured, $110-130\ \mu$ high. Paraphyses at their apices capitato-incrassate ($4-5\ \mu$), and constrictedly septate, unbranched or rarely with a few short branches. Asci $80-85\ \mu$ long, $15-17\ \mu$ thick, octosporous. Spores variable, type regularly ellipsoidical with rounded apices. On an average they are not thicker than half the length (average size of all measured spores: $21,41\ \mu$ long, $9,47\ \mu$ thick), but broader spores are frequently seen (e. g. $17 \times 11\ \mu$). Cell rooms usually angular, stretched across of the spore, or like a sand-glass, the septum is thick, the canal distinct. Deformed, shrunk spores are more frequent than in other *Physciae*. Size: $17-26,3\ \mu$ long and $7,9-13,4\ \mu$ thick. Colour as usual.

Pycnides small, globose, $90-95\ \mu$ in diam. Perifulerium dark around the ostiolum, otherwise uncoloured. Pycnoconidia small, narrowly ellipsoidical: $2,5-3,5\ \mu$ long, $0,8-1\ \mu$ thick.

React. The coloured part of the medulla purple by KOH, otherwise the thallus is neither coloured by KOH nor by CaCl_2O_2 . Hymenium first blue then deep red by J, the blue colour of the asci subpersistent.

Hab. In Norway it is only recorded as saxicolous. It prefers moist rocks and stations with an ample supply of nitrogen. Frequently associated with *Ph. lithotea*.

Loc. Recorded only from a few stations in our country, evidently more frequent in Southern than in Northern Norway. Southeastern Norway: Ringebu (LYNGE), Toten (SOMMERFELT), Gjeilo (LYNGE); Southern and Western: Lyngør (LYNGE), Granvin, plentiful and well fertile (HAVAAS), Gjølra in Sundalen (HAVAAS), Veblungsnes and Skiri in Romsdalen (HAVAAS). Trondhjem district: Trondhjem (KINDT), Opdal (HAVAAS). Northern Norway: Harstad (NORMAN).

Many authors have referred *Ph. endococcina* to *Ph. obscura* or to *Ph. lithotea*, and with good reason, for the coloured medulla is occasionally only found in some laciniae, and is absent in others of the same specimen.

15. *Physcia sciastrella* (NYL.) HARMAND.

Parmelia obscura (EHRH.) f. *sciastrella* NYL. in lit. in ARNOLD Die Lichenen des fränk. Jura. Flora (1874) p. 569 (no description).

Physcia lithotea var. *sciastrella* NYLANDER De gonidiis et eorum formis etc. Flora (1877) p. 354 (note). ZAHLBRUCKNER Zur Flechtenflora des Presburger Comitatus II. Verh. des Vereins für Natur- und Heilkunde zu Presburg vol. XIX (X) (1899) p. 4.

Physcia parvula WAINIO Lichenes Viburgenses. Meddel. Soc. Fauna et Flora Fennica vol. II (1878) p. 52. OLIVIER Lichens d'Europe I (1907) p. 246.

Physcia orbicularis d. *sciastrella* DALLA TORRE et SARNTHEIM Die Flechten von Tirol etc. (1902) p. 167.

Physcia sciastrella HARMAND Lichens de France (1909) p. 651, tab. XVI, fig. 8. LETTAU Beiträge zur Lichenographie von Thüringen. Hedwigia vol. LII (1912) p. 255.

EXSIC. ARNOLD 583 (non vidi), LOJKA Lich. Univ. 223 (non vidi), NORRL. et NYL. Herb. Lich. Fenn. 219.

WAINIO collected the plant of NORRL. et NYL. 219, and NYLANDER has recognized the determinations. On the label it is stated that *Ph. parvula* WAIN. is a synonym of *Ph. obscura* f. *sciastrella* NYL. OLIVIER (l. c.) enumerates them as two different species, but the above statement by the two »patres nominum» must in this respect be decisive.

The priority of the name must be based upon NYLANDER in ARNOLD Lich. Exs. 583: »*Parmelia obscura* (EHRH.) var. *sciastrella* NYL.« The names in Flora 1874 and 1877 are only Nomina nuda, without description. I have been unable to ascertain the exact date of publication of ARNOLD 583; it was mentioned in Flora 1874 p. 569 and therefore most probably appeared before 1874. (No. 446 was published in 1871, and No. 737 in 1879). In that case WAINIO's name from 1878 is a later name.

Thallus growing in small irregular patches 1—1,5 cm. in diam., but frequently confluent. Laciniae ascendant to erect, very thin (70—90 μ), loosely imbricate, short and very narrow (0,2—0,3 mm. broad) with undulate or incise margin, either dilated at their apices like a fan and profoundly digitato-laciniate or equally broad and profoundly lacerate or pinnato-incise. Laciniae at the margin instructed with pedicellate, furfuraceous or rather elongate, branched, coralliform isidia. If the cortex of the isidia is broken off, medullary hyphae sometimes grow out forming pseudosoredia, genuine soredia not developed. Thallus opaque, colour varying from pale grey to greyish-brown or even brownish-black, when moistened with a strong tinge of green. Lower side uncoloured.



Fig. 10.
Physcia sciastrella (Nyl.) Harm.

Upper cortex 15—25 μ thick, surface unequal, insperse, more or less opaque at the exterior part, otherwise uncoloured. Hyphae indistinct, 5—6 μ thick, constrictedly septate with rounded articuli, occasionally less constricted.

Isidia distinctly corticate, sometimes their cortical hyphae grow out to short hair-like, uncoloured emergences (water absorption?). Gonidia crowded, at the central, inner part of the laciniae arranged in their normal position under the upper cortex, at the free, ascending apical part quite as much within the lower cortex. Medulla white, with narrow, densely interlaced, occasionally even apparently plectenchymatous hyphae, gradually transformed into the lower cortex, which is but slightly different from the medulla. Rhizinae 80—90 μ thick, uncoloured or pale greyish.

Apothecia and fertile pycnides not seen in Norwegian plants; HARMAND gives the size of the spores at $16,5-27 \times 7,5-10 \mu$, accordingly a little longer than in *Ph. lithotea* (HARMAND $21-24 \times 12 \mu$, in this paper: $15,7-22 (24) \times 7,4-11 (13)$).

React. Cortex as well as medulla uncoloured by KOH as well as by CaCl_2O_2 . (According to HARMAND: »Hymenium J + bleu persistant«).

Hab. and loc. This species is certainly rare in Norway, though probably overlooked on account of the minute and only slightly conspicuous thallus. Only recorded on sunny, dry, chalky rocks at Leangen in Asker near Kristiania (LYNGE), associated with *Ph. virella* and *Ph. lithotea* and at Granvin in Hardanger on the cortex of *Sorbus Aucuparia* (LYNGE). There were no transitional states between *Ph. lithotea* and *Ph. scia-strella*. — In southern countries chiefly on bark. It is a well known fact that towards their northern limit of distribution several corticolous Lichens are also or exclusively found on rocks¹.

The laciniae are so narrow that they might as well be called ramose as incise. On account of the thin thallus, really good sections are not easily obtainable. Thick sections are liable to give the investigator the false impression of a plechtenchymatous medulla.

The position of the gonidia is of a special interest. Their normal place under the upper cortex is not of a fixed nature, if the (morphological) lower side of erect laciniae offers sufficient opportunities for assimilation the gonidia are also developed within the lower cortex.

16. *Physcia caesia* (HOFFM.) NYL.

Lichen caesius HOFFMANN Enumeratio Lichenum (1784) p. 65 et tab. XII, fig. 1 (excellent). ACHARIUS Prodomus (1798) p. 107. WAHLENBERG Flora Lappon. (1812) p. 422.

¹ Cfr. EDWIN NYLANDER: Laf-vegetationen uti Savolax p. 62.

Lichen pulchellus WULFEN in JAQUIN Collectanea vol. II (1788) p. 199, tab. XVI, fig. 2 (miserable).

Psora caesia HOFFMANN Plantae lichenosae (1790) p. 37, tab. VIII, fig. 1.

Parmelia caesia ACHARIUS Methodus (1803) p. 197, Lich. Univ. (1810) p. 479, ACHARIUS Synopsis (1814) p. 216. Flora Danica (1849) tab. 2507, fig. 1 (miserable).

Physcia stellaris b. *caesia*. DEICHMANN BRANTH et ROSTRUP Lich. Dan. (1869) p. 65.

Physcia caesia. NYLANDER Prodrömus (1857) p. 308, NYLANDER Synopsis (1860) p. 426, TH. FRIES Lich. Arctoi (1860) p. 64, NYLANDER Lich. Scand. (1861) p. 112, MÜLLER u. PABST: Flechten (1876) tab. V, WAINIO Adjumenta (1881) p. 137, CROMBIE Brit. Lich. I (1894) p. 317, DALLA TORRE et SARNTHEIM Flecht. Tirol (1902) p. 163, OLIVIER Lich. Eur. I (1907) p. 243, HARMAND Lich. France (1909) p. 629, LYNGE Blad- og busklaver (1910) p. 102.

Exsic. ANZI Ital. sup. 121 (soredia not well developed), ANZI Lang. 312 (not like our specimens), ARNOLD Lich. Exsicc. 1449, CLAUD. et HARM. Lich. Gall. praec. 74, FLOERKE Deutsche Lich. 71, FRIES Lich. Suec. 323 (not seen), MERRILL Lich. Exsicc. 101, MIGULA Krypt. 43, STENHAMMAR Lich. Suec. 212 supr. (inf. is *Ph. tenella*), TUCKERMAN Lich. Amer. Sept. 86. (SCHAER. Lich. Helv. 347 is not *Ph. caesia*).

Thallus middle-sized, orbicular, diam. 2—4, rarely 5 cm. Laciniae closely attached to the substratum, stellate, contiguous or with imbricate ends, multifid with acute angles, pinnate or furcate, equally broad (0.5—1 mm.) or cuneate and narrowly affixed. Small papillaceous or branched secondary laciniae are frequent towards the centre. The laciniae are convex, rugulose and minutely albomaculate, with a chalky splendour, without isidia or pruina, but instructed with globose caesious soredia, (diam. 1—2 mm.), soredia more or less crowded, in old thalli sometimes confluent. The soredia are found on the surface of the central parts or (see var. *dubia*) at the end or along the margin of the laciniae. Colour white or greyish-white (except the soredia), when moistened the colour is almost unaltered but the white dots become more conspicuous. Lower side dark with black, branched rhizinae.

The upper cortex has an adspersed surface; at the exterior part (20—25 μ) it is dark, grey, and impellucid, even in thin sections; otherwise it is uncoloured. Cortical hyphae plectenchymatous, constrictedly septate, more or less perpendicular to the surface (add KOH). The cortex varies from 0 (soredia) to 40—70 μ thick. Gonidia glomerate in a very irre-

gular, interrupted stratum with varying distance from the surface. Usually the dark upper part of the cortex is thicker above more protruding gonidia clusters (protection). Lower cortex 30—40 μ thick, usually well marked off from the medulla; its exterior part is dark, brown or black; otherwise it is colourless. The majority of its hyphae are more or less parallel to the surface, but many of them have another direction, even perpendicular to the surface. Rhizinae 90—105 μ thick.

Apothecia are not rare, though the thallus is usually sterile. They are small, rounded with diam. 0,5—1 mm., scattered or sometimes crowded in the central part of the thallus; they are closely appressed with persistent, originally entire, later on crenate margin, and plane, brownish or black, more or less albo-pruinose disc. Receptacle rugose, pale yellow, its cortex uncoloured or at the exterior part faintly shadowed, 0—160 μ thick, hyphae plectenchymatous, at least at the exterior part perpendicular to the surface. The gonidia fill up the medulla of the margin; they are also numerous within the whole cortex, under the hypothecium and more frequent in the medulla than usually in the genus. Hymenium reddish-brown and very insperse at the upper part (epithecium), otherwise uncoloured, 65—80 (100) μ thick. Paraphyses at their ends clavately incrassate, constrictedly septate, undivided or frequently dichotomously branched. Asci octosporous, clavate, rather narrow, 60—80 μ long, 15—17 μ thick. Spores often poorly developed, straight, ellipsoidal or slightly fabaceous, a little constricted at the septum, rounded at the ends. Cell room small, angulose, stretched across the spore, or sometimes rounded. Spores (13) 16—22 μ long, (7) 7,7—9,5 (10) μ thick.

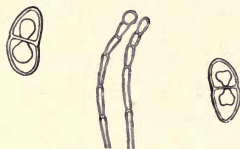


Fig. 11. *Physcia caesia*
(Hoff.) Nyl.

Pycnides very numerous, globose, diam. 130—160 μ ; perifulcrum almost uncoloured; pycnoconidia cylindrical or slightly incrassate at the middle, 3—4 μ long. The pycnides are quickly emptied, senile pycnides are depresso-globose with black perifulcrum and prominent ostiolum.

React. Cortex as well as medulla yellow by KOH, not coloured by CaCl_2O_2 . Hymenium first blue, then at once dark blue or black, or sometimes sordid vinous by J.

Physcia caesia has an extensive horizontal as well as vertical distribution in our country. It is frequent through the whole country and ascends from the shore at least to 1400—1500 m. in Central Norway (Finse), at least on chalky and schistose substratum. It is also found — though

not so frequently — on primitive rocks and eruptives, sometimes on the bark of deciduous trees, but rarely on moss. It is a nitrophilous species and has a great predilection for wayside curb-stones, walls of stables and the like, and maritime rocks.

Loc. Very frequent near Kristiania (many stations, M. N. BLYTT, MOE, LYNGE), in Bærum and Asker (LYNGE), frequent in the central lowlands: Sundvolden (HAVAAS), Minne and Tingelstad (LYNGE), Ringebu (SOMMERFELT), Fæmunden, Hunder, Næverfjeld (LYNGE), Gudbrandsdalen (NORMAN), Hol (LYNGE), from the central highlands: Dovre (many stations, M. N. BLYTT, ZETTERSTEDT, and others), Finse (LYNGE). Most probably frequent along the south coast, though only collected from few stations: Tønsberg, and Vasser (LYNGE). In Western Norway it is frequent from the shore to the interior, but it does not frequently surpass 800 m. (HAVAAS); loc.: Rægefjord, Moster, Kinsarvik and Eide (HAVAAS), Voss (lignicola, LYNGE), Hardangervidden: Vivheller (HAVAAS), Lygrefjorden and Stat (HAVAAS), Romsdal (LINDSAY). Frequent about Trondhjem: Ladehammeren (KINDT) and Sorgenfri (LYNGE). Nordland: Saltdalen (SOMMERFELT). North of Salten it is known from innumerable stations, especially along the coast: Rolla, Havnvik, Gibostad, Kvaløen, Nordbynesset, Fløifjeldet, Mikkelvik, Goalsevarre and Astejok in Tromsø amt (LYNGE), and in Finmarken from Alten; Sakkabani (NORMAN) and Storkviknesset (TH. FRIES), from Porsanger: Honningsvaag, Lakselv and Skoganvarre (LYNGE), from Tanen: Goalsevuoppe (TH. FRIES), and from Varanger: Næsseby, Mortensnes and Pasvikelven (TH. FRIES).

In 1910 I collected a specimen near Gibostad on the island of Senjen in Northern Norway. A part of the specimen was left. In 1911 I visited the place again at the same season, and found that the laciniae had grown as much as 1—3 mm. from the surface of the cut. This is a rapid growth for a Lichen. It is probable that nitrophilous species grow quicker, because they are better fed than other Lichens.

TH. FRIES mentions a *Physcia caesia* var. *albinea*¹ (thallus KOH \pm) from maritime rocks in Northern Norway. This is certainly not *Physcia albinea* (ACH.) NYL. (thallus KOH \pm). Our only specimen of this belongs to *Ph. caesia*; it has large apothecia and poorly developed soredia. Such plants are not rare on maritime rocks, as stated by TH. FRIES. — The late Mr. LÅNG saw other specimens, named var. *albinea*, which belonged to *Ph. intermedia* WAIN.

¹ Lich. Arct. p. 64.

Physcia caesia NYL. is recorded to have been found in Northern Finland, not far from our frontier¹. I have never seen it from Norwegian stations.

f. *adscendens* n. f.

Apices laciniarum adscendentes vel etiam erectae; laciniae imbricatae, convexae, multifidae, pinnatae vel profunde crenato-incisae, apice vulgo flabelliformiter dilatatae, rugosae; laciniae secundariae numerosae, parvae, papillaeformes. Praeterea ut in specie.

Loc. Central Norway: Finse (Sandalshøgen) 1450 m. s. m. (LYNGE).

This form is not very significant, probably only a luxuriant individual variation. On the other hand the closely appressed laciniae are very characteristic of *Ph. caesia*, and this variation (or form) deserves a name.

f. *alpina* n. f.

Differt a specie sorediis isidiiformibus, papillatis, depressoglobosis vel subplanis, limitatis, pro parte corticatis, obscuratis vel thallo concoloribus.

Praeterea ut in specie.

Hab. On schistose and calcareous rocks, in Southern Norway in alpine situations, in Northern Norway at all elevations; frequently associated with *Physcia tribacia*.

Loc. Central mountains: Gjeilo and Finse (LYNGE), Northern Norway: Rolla in Ibbestad, Gibostad in Senjen, Norbynesset in Malangen, Skoelvdalen in Maalselven, and Tromsøen (LYNGE).

This is a rather characteristic variety, due to the peculiar development of the soredia, representing an intermediate state between soredia and isidia. Occasionally the soredia are poorly developed, in other specimens they are almost confluent. — It is impossible to attribute the form of the soredia to climatic influence, for the thallus is otherwise well developed, and it frequently grows associated with the type. — The colour of the thallus and the development of the laciniae vary as in the typical *Ph. caesia*.

¹ NORRLIN, J. P. Berättelse i anledning af en till Torneå Lappmark verkställd naturalhistorisk resa. Not. Sällsk. Fauna och Flora Fennica förh. vol. XIII, 1873, p. 326.

var. *dubia* (HOFFM.?, ACH.) TH. FR.

an *Lobaria dubia* HOFFM. Fl. Germ. (1795) p. 156 (not seen)?

Lichen dubius. ACHARIUS Prodrum (1798) p. 123.

Parmelia caesia var. *dubia* ACHARIUS Methodus (1803) p. 197. ACHARIUS Lich. Univ. (1810) p. 479.

Lichen caesioides var. *dubia* WAHLENBERG Flora Lapponica (1812) p. 422.

Physcia caesia var. *dubia* TH. FRIES Lich. Scand. I (1871) p. 141. DALLA TORRE et SARNTHEIM Die Flechten von Tirol (1902) p. 164.

I have seen neither an authentic plant from HOFFMANN, nor his description in Flora Germanica. If his plant is identical with ours we must write the author: »(HOFFM.) TH. FR.«. If not, ACHARIUS is the oldest author. It is evident from the description of ACHARIUS in Lich. Univ. — where ACHARIUS Prodrum is cited as a synonym — that his plant is identical with ours. ACHARIUS Prodrum was edited in 1798, FLOERKE Deutsche Flechten No. 72 in 1819.

EXSIC. ARNOLD Lich. Exsicc. 1724, FLOERKE Deutsche Flechten 72, FUNCK Krypt. Gewächse 417, LEIGHTON Lich. Brit. 323, MALME Lich. Succ. 353 (intermediate between var. *dubia* and the type), SCHAEER. Lich. Helv. 348 (according to ARNOLD Jura, absent in our copy).

According to ARNOLD Jura p. 50 »STENH. 212 sup. sin.« belongs to this variety, in our copy of the said collection No. 212 supr. is the typical *Ph. caesia*.

Thallus orbicular, middle-sized, diam. 2—5 cm., laciniae appressed or slightly ascendent at the apices, narrow, discrete and stellate or broader, contiguous, and indistinctly stellate. The apices of the laciniae (more especially those of the secondary laciniae) dilated, recurved, and covered with minute granular soredia, which may ultimately attain a coraloid, isidiate appearance. Surface minutely regulose and with whitish dots. The colour varies from white to ashgrey, nearly colourless beneath, with a few, darker fibrillae.

Apothecia not frequent. Margin thin, crenulate, sometimes sorediate. Paraphyses, spores and the other anatomical characters as in the type.

Hab. The Norwegian specimens in our herb. are found on rocks, usually near the water. (FLOERKE No. 72 from wood).

Loc. It is usually associated with the type; it is not frequent, but has a wide distribution: Southern Norway: Malmøen (MOE s.n. *P. caesia* β *albinea*), and Næsøen (LYNGE) near Kristiania, Lyngør (LYNGE), Western: Moster (HAVAAS and LYNGE), Sunde near Luksund (HAVAAS). Central:

Odnesberget in the parish Land (NORMAN), Vaage (LYNGE), Finse (LYNGE), Northern: Salfdalen (SOMMERFELT), Astejok near Altevand, and Mestervik in Malangen (LYNGE).

Specimens with dilated laciniae and typical soredia might be confounded with darker states of *P. tribacia*, from which it is readily distinguished by the medullar reaction. One specimen from Saltdalen is large, quite fertile, and nearly esorediate, it might be mistaken for *P. melops*.

MASSALONGO describes some anatomical characters of his *Anaptychia stellaris* δ . *dubia* (Mem. 1855, p. 37), he found smaller asci than in our *Ph. caesia*. His figure (tab. VI, fig. 35) is incorrect, giving unseptate paraphyses.

* *ventosa* subsp. nov.

Differt a specie colore cinereo-violascenti vel caeruleo-violascenti (humectata immutata), laciniiis elongatis, discretis vel minus arcte contiguis, et sorediis minoribus. Thallus fragilis, cortex saepe ruptus.

Thallus strato hyalino, 5–8 μ alto, postremo insperso-rupto, tectus. Hyphae corticis superioris plectenchymaticae, superficiei perpendiculares, transversim septatae. Articuli exteriores obscuriores (20–25 μ), valde impellucidi. Gonidia strato incontinuo sub cortice formantia, saepe perpendiculariter in corticem usque ad stratum obscurum crescentia. Medulla alba. Cortex inferior totus, vel utique parte exteriore, obscurus, rufescens vel rufescenti-nigrescens. Rhizinae nigrae.

Apothecia rarissima, sessilia vel etiam adpressa, rotundata, diam. 1–2 mm. Margo integer vel dein crenatus, interdum soredioso-fatiscens, discus planus, epruinosis, receptaculum rugulosum, flavescens vel pallide cinereo-flavescens. Cortex receptaculi usque ad 130 μ altus, parte exteriore solum leviter obscuratus. Gonidia numerosa, praecipue in marginem apotheciorum, etiam infra corticem receptaculi et sub hypothecio disposita. Hymenium superne obscure fusco-rubescens, inspersum, praeterea incoloratum, 80–90 μ altum. Paraphyses validae, sat facile liberae, apice leviter solum clavato-incrassatae, constrictae septatae, indivisae vel plus minusve ramosae. Asci 75–80 μ longi, 16–20 μ crassi, membrana apice incrassata. Sporae rectae, late ellipsoideae, apice rotundatae, medio non vel levissime constrictae, 17–21 μ longae, 9,5–12,4 μ crassae. Lumen parvum, angulatum, in transversum sporarum elongatum, rarius rotundatum.

Pycnides fertiles frustra quaesivimus.

React. Thallus extus et intus KOH flavescens, CaCl_2O_2 non mutatur. Hymenium J caeruleum, dein persistenter caeruleo-nigrescens vel nigrescens.

f. *convexa* n. f.

Tab. I, fig. 2.

Major et robustior, laciniae convexae, latiores, minus divergentes ramosae et subcontiguae. Soredia thallo concoloria vel in colorem caesium vergentia, vulgo sparsa, subsidiiformia, granulosa, sat sparsa vel rarius numerosa, globosa, pulverulenta. (Soredia vera, soralia). Thallus maculis albis plus minusve perspicuis instructus.

f. *plana* n. f.

Tab. I, fig. 3.

Minor, gracilior, laciniae planae, angustae, elongatae, divergentes ramosae et eam ob causam discretae. Soredia (vera) parva, alba, depresso-globosa. Thallus maculis albis perspicuis dense instructus. Rhizinae inter lacinias distinctae.

Ad rupes perpendiculares subalpinas et alpinas soli et vento valde expositas, crescens, socio *Caloplacae elegantis*.

f. *convexa* is frequent along the Kristiania—Bergen railway from Hol to Finse, 550—1450 m. s. m. (LYNGE), also known from Dovre (herb. KJÆR), and from Skoganvarre in Finmarken (LYNGE).

f. *plana* is only known from Arctic Norway: Skibotn in Tromsø amt, and Skoganvarre in Finmarken (LYNGE).

Not. It is evident from the description that there is no great difference between the two formae, which most probably only represent individual variation. The affinity of the subsp. *ventosa* is with *Ph. caesia*, it is separated from this species by its colour, more discrete laciniae, less coherent and less incrassate paraphyses, and by broader spores. It has another distribution: *Physcia caesia* is a lowland species which only rarely surpasses the forest limit (900 m. in Central Norway), our subspecies is markedly subalpine and alpine. — The apothecia are very rare, and usually sterile.

The appearances of *P. caesia* and the subspecies are so different that if there were only a few specimens, it would have been natural to describe them as two different species. But a very rich material, combined with observations in nature, has shown me specimens, which seem to be intermediate.

17. *Physcia teretiuscula* (ACH.) LYNGE.

Parmelia caesia β *teretiuscula* ACHARIUS Lich. Univ. (1810) p. 479 (p. p.)

Physcia caesia var. *teretiuscula* NYLANDER Lich. Scand. (1861) p. 112.

TH. FRIES Lich. Scand. I (1871) p. 141. WAINIO Adjumenta I (1881) p. 135.

CROMBIE British Lichens I (1894) p. 318. BOISTEL Nouvelle Flore des Lichens 2^e partie (1903) p. 73.

an syn. *Physcia leptalea* var. *subteres* HARMAND Lichens de France (1909) p. 622; CLAUD. et HARM. Lich. Gall. praec. exsic. 319 (sub *Ph. albinea*).

Thallus small or middle-sized, orbicular, diam. 1—1.5—3 cm.; more extensive thalli are often seen, formed by confluent individual thalli. Laciniae appressed to the substratum or only occasionally slightly ascendent at the apices, flexuose, elongate and very narrow (0.2—0.3 mm. broad), slightly dilated at the apices, more or less convex, very multifid, repeatedly furcate or pinnate, divaricate and discrete, in young isolated thalli distinctly stellate, later imbricate and sometimes intricate. Soredia white, small and inconspicuous, difform: either scattered over the surface of the thallus or terminal, formed on the lower side of the slightly ascending apices of some laciniae (*tenella* type). Colour varying from ash-grey to white (not brownish), under side colourless, rhizinae long, dark or even black.

Thallus covered with an amorphous, uncoloured stratum, 5—8 μ thick. Upper cortex 25—40 μ thick, dark and opaque at the exterior part, otherwise pale or uncoloured. Hyphae very indistinct, slightly constrictedly septate, spreading in many directions from between the glomerate gonidia, and arranged in contiguous palissades at the exterior part. Medulla white, gradually transformed into the lower cortex. Lower cortex uncoloured or only locally slightly darkened, hyphae chiefly parallel to the surface.

Thallus substerile, only a few scattered initiating apothecia without spores. Pycnides not seen.

Reaction. Cortex and medulla distinctly yellow by KOH, no colouring by CaCl_2O_2 .

Loc. Recorded only from chalky substratum near the shore in Northern Norway: Ibbestad and Malangen: Nordbyneset in Tromsø amt (LYNGE), Tromsø (LYNGE).

According to WAINIO (l. c.) *Ph. caesia* β *teretiuscula* ACH. »composita est e *Ph. tribacia* (K \pm) et e forma insigni forsán *Ph. caesia*, reactione K \ddagger at habitu *Ph. tenellae* et lacinii apice pulverulentis, . . . forsán haec forma est autonoma species«. This note, combined with the description, given by ACHARIUS (l. c.), leaves no doubt that our plant is identical with the latter of the two forms, mentioned by WAINIO. It cannot be referred to *Ph. caesia*, differing from that species by the narrow elongate laciniae, the colour, and the structure of the soredia. Some specimens resemble a narrowly lacinate *Ph. tenella* or *Ph. tribacia*, from which it is well separated by the positive reaction of the medulla. It seems to me that its nearest relation is with *Ph. intermedia*; it agrees in some respects with young states of that species, but differs in the purely ash-grey or white (never brownish) colour, the very narrow, filiform discrete laciniae, and the small and inconspicuous soredia; *Ph. intermedia* is usually well fertile. WAINIO supposed it to be a proper species, and I agree with him on this question. It is no advantage to descriptive botany to unite plants, which can be kept apart.

HARMAND and BOISTEL state (l. c.) that the var. *teretiuscula* or *subteres* has the reaction: K \pm . It is therefore probably not identical with our plant. In our copy of the collection CLAUD. et HARM. 319 is worm-eaten and the remains insufficient for comparison.

18. *Physcia intermedia* WAIN.

Physcia intermedia WAIN. Lich. Vib. p. 51. Meddel. Soc. pro Fauna et Flora fennica vol. II (1878). OLIVIER Lich. Eur. I (1907) p. [163] 239.

Thallus middle-sized and orbicular or large, difform, up to 10—15 cm. large, very fragile. Laciniae stellate, discrete—subcontiguous or closely contiguous—imbricate; they are slightly convex, linear, frequently with crenate margins, narrow, 0.2—0.5 mm. broad, closely appressed, or free from the substratum at their apices. Thallus not isidiate, but sprinkled with low, depressoglobose or even crateriform soredia, formed on the surface of the thallus, and at the apices of the short lateral branches, more rarely at the circumference of the thallus. They are sometimes quite confluent, covering the whole thallus, or leaving only a few free laciniae along the circumference. Thallus opaque, albo-maculate, but not always distinctly, epruinose

(I have only seen one thallus locally covered with a thin white pruina); colour brownish or greyish-brown, darker at the centre. Soredia of the same colour or whitish. Under side uncoloured with numerous short rhizinae, which are uncoloured or brown.

Upper cortex of variable thickness, from 20 to 50, rarely 80 μ thick. Hyphae plectenchymatous, septate with rounded articuli. Exterior articuli dark, impellucid, interior ones uncoloured. Medulla white, hyphae loosely interlaced, gradually transformed into the lower cortex, which has hyphae more parallel to the surface.

Apothecia sessile or very shortly pedicellate, scattered and rounded 1–2 mm. in diam., or more numerous and angulose, owing to mutual pressure. Margin crenate, frequently sorediate, receptacle rugose, paler than the thallus. Disc plane, epruinose or very rarely caesio-pruinose, black or brownish-black, moistened brown. The cortex of the receptacle 75–90 μ thick, uncoloured, hyphae plectenchymatous, perpendicular to the surface, at least at the exterior part. Hymenium 80–100 μ thick, at the exterior part brown, otherwise uncoloured. Paraphyses moderately clavato-incrassate, constrictedly septate, individed or sometimes furcate at their apices. Spores ellipsoid, rounded at their ends, straight or slightly curved, a little narrowed at the septum, 16–22 μ long, 8–11,5 μ thick. Spore-rooms angulose.

Pycnides immersed, conical or depresso-globose, diam. 100–175 μ . Perifulcrum uncoloured except at the ostiolum, where it is dark. Fulcra undivided, endobasidial, short, constrictedly septate, articuli 4,5–5 μ long, and 3,5–4 μ thick. Pycnoconidia straight, slightly apiculate, 3,5–4 μ long, and 0,5–1 μ thick.

React. Cortex and medulla yellow by KOH, no colour with CaCl_2O_2 . Hymenium persistently blue or dark bluish-black with J.

var. *stellata* n. var.

Physcia intermedia WAIN. l. c.

Tab. II, fig. 2.

Thallus orbicularis, parvulus, diam. 2–3 cm., *laciniae angustae, elongatae, bene radiantes*, discretæ vel subcontiguæ; *soredia parva dispersa*.

Loc. In Norway it is found on micaceous ground in Northern Norway, chiefly along the shore, but also in the interior: Pasvikelven (third cataract) and Sjaaholmen in Sydvaranger (Th. FRIES s. n. *P. caesia*), Tromsø amt: Sørkjosen, Skibotn, Lyngseidet, Tromsøen, Nordbynesset (LYNGE).

var. *Wahlenbergii* LYNGE comb. nov.

Tab. I, fig. 1.

Syn. *Physcia Wahlenbergii* Lynge. Neue Flechten aus Norwegen. Berg. Mus. Aarbok (1912), no. 10, p. 7, tab. I, fig. 1.

Thallus major subcrustiformis, sorediis confluentibus fere tectus, laciniae breviores, vulgo indistinctae.

Loc. Found along the shore of Northern Norway, but not frequently. Tromsø amt: Tromsø and Nordbyneset (LYNGE).

Dr. WAINIO was kind enough to send me a specimen of *Ph. intermedia* for comparison. As stated by WAINIO his specimens have the habitus of *Ph. stellaris*. — The medullary reaction in his specimens is next to imperceptible, as is also the case in some of mine; in others, however, the reaction is more distinct. Owing to the very narrow laciniae the medullary reaction is not easily perceptible. Sections always give faint reactions. I removed the upper cortex and observed the reaction directly on the plant under the microscope. — Old specimens, especially the var. *Wahlenbergii*, have more the habitus of *Ph. caesia*. In my opinion *Ph. intermedia* belongs to the *Ph. caesia* tribe.

It is separated from *Ph. caesia* by its colour and by the form of the soredia. Plants growing in the shade are brighter of colour; if they have sorediate apices, they may be confounded with *Ph. trihacia*, from which species they are separated by the positive medullary KOH-reaction, and by narrower laciniae. Inexperienced investigators might confound it with *sciastra*-states of *Ph. lithotea*, but all other differences apart, *Ph. lithotea* is KOH $\frac{+}{-}$.

My *Ph. Wahlenbergii* is so different from WAINIO's description that it was described as a n. sp., but a large material, and observation in nature have now shown me intermediate states. The difference is, however, so great that it is impossible to regard them as mere synonyma. It will be natural to describe them as two varieties of the same species.

19. *Physcia melops* (DUF.) NYL.

Parmelia melops DUF. (according to NYLANDER Addenda nova l. c.).

Physcia melops (DUF.) NYLANDER, Addenda nova. Flora 1874, p. 16. CROMBIE Brit. Lich. I (1894) p. 315. NYLANDER Lich. Paris (1896) p. 42. DU RIETZ Lich. anteckn. (1915) p. 4.

Physcia caesia f. *melops* (DUF.) WAIN. Pitlekai (1909) p. 68. HARMAND Lich. France (1909) p. 630.

An syn. *Lichen alboniger* SCHLEICHER Pl. crypt. helvet. No. 71 (1806), and

Physcia albonigra (SCHLEICH.) DALLA TORRE et SARNTHEIM Die Flechten von Tirol (1902) p. 164, (ubi syn.).

Tab. I, fig. 4.

Exsic. According to DALLA TORRE et SARNTHEIM l. c. ARNOLD No. 897 belongs to our species; which must be a misprint (ARNOLD 897: *Lithoidea viridula* (SCHRAD.) var. *elevata* NYL.) ARNOLD no. 1648 (*Parmelia albonigra* SCHL.) differs considerably from our plant in having an entirely white thallus of a *Ph. aipolia*-like exterior. I have seen neither the specimens of DUFOUR nor those of SCHLEICHER. The Norwegian material was determined by the late, eminent Finnish lichenologist, Mr. LÅNG.

Thallus moderate or large, orbicular, diam. 6—10 cm., loosely adnate, firm. Laciniae contiguous, often with imbricate apices, distinctly stellate and continuous from the centre to the circumference, convex, rugulose or smooth, with indistinct pale spots, linear, narrow: 0,5—0,7 mm. broad, with undulate outlines, multifid, pinnately branched; branches more or less divergent with acute angles. Thallus without soredia, isidia or pruina. About the centre we may find small, papillary, secondary laciniae, which fill up the interstices between the great primary laciniae. Colour ash-grey with a tinge of violet, under side pale brown or greyish-brown, nearly covered by long, dark or even black, branched rhizinae.

The impellucid part of the upper cortex is darker, and the under cortex paler than in *Ph. caesia*. In other respects the thallus anatomy is as in *Ph. caesia*.

Apothecia very numerous, sometimes covering the central part of the thallus, they are sessile, not appressed, sometimes very shortly pedicellate. They are small, diam. 1—1,5 mm., rounded or angulose, due to mutual pressure, with persistent, at length crenate margin and plane, epruinose disc. Receptacle of the same colour as the thallus or a little paler, smooth. Cortex at the exterior part pale brownish with its hyphae perpendicular to the surface, otherwise uncoloured. The position of the gonidia, form of hymenium and paraphyses as in *Ph. caesia*, only that the paraphyses are less incrassate. Spores not constricted at the centre, otherwise as in *Ph. caesia*, 16,6—20,5 μ long, 7,9—8,6 μ thick.

Pycnides must be rare, only a few sterile ones found.

Reaction: Cortex and medulla coloured yellow by KOH, uncoloured by CaCl_2O_2 .

Loc. Kristiania: Ekeberg (on Ryenbergene and near a land-mark (Norwegians varde), found by N. G. MØE in 1868). MØE named it *Ph. caesia*, but he was fully aware of its being a remarkable variety¹. Dovre: Drivstuen (ZETTERSTEDT 1870, s. n. *Ph. stellaris* var. *aipolia* (Ahb. Upsala), Knutshø (LYNGE).

On naked, or mossy rocks.

It is closely related to *Ph. caesia*, but differs by the colour, the absence of soredia, the crowded, numerous apothecia, and the *Placodium*-like appearance. It bears some resemblance to *Lecanora melanaspis*.

¹ herb. not.: »høist udm. Form, vakker, merkelig«.

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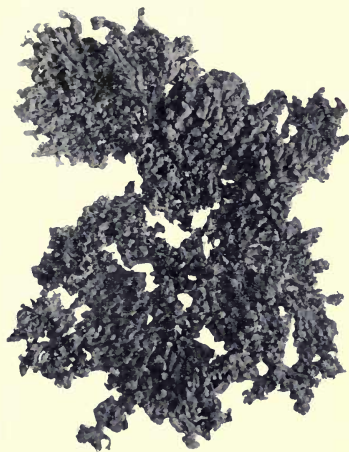
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— 6. *Physcia tenella* var. *leptalea* (ACH.) (spores and paraphysis).
— 7. *Physcia pulverulenta* var. *allochroa* (EHRH.) TH. FR. (spores).
— 8. *Physcia lithotea* (ACH.) NYL.
— 9. *Physcia tremulicola* NYL. (plant).
— 10. *Physcia sciastrella* (NYL.) HARM. (plant).
— 11. *Physcia caesia* (HOFFM.) NYL. (spores and paraphysis).
-



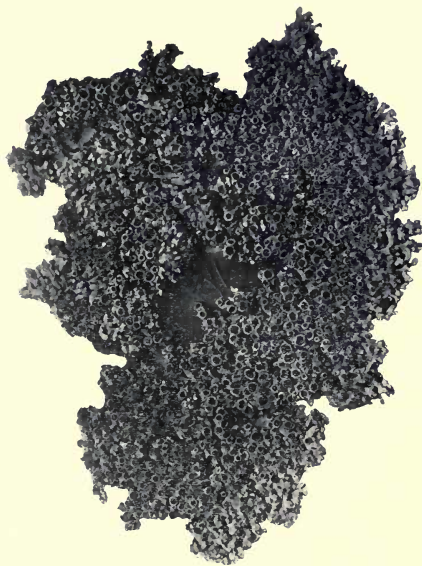
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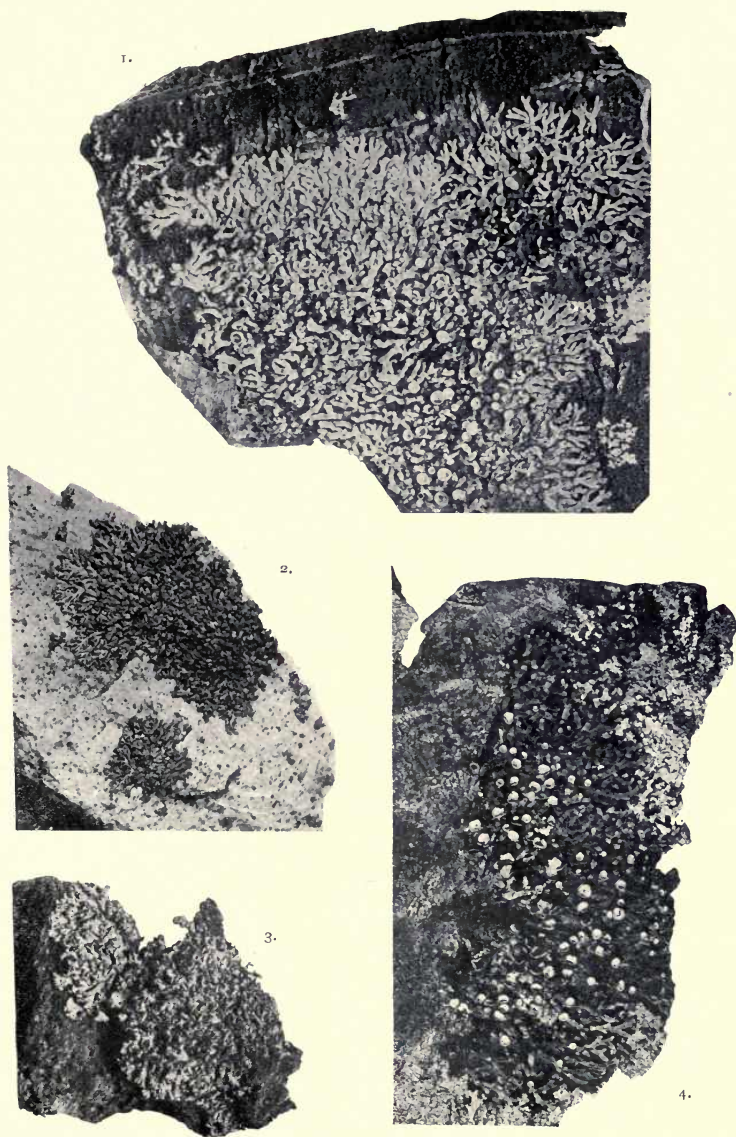


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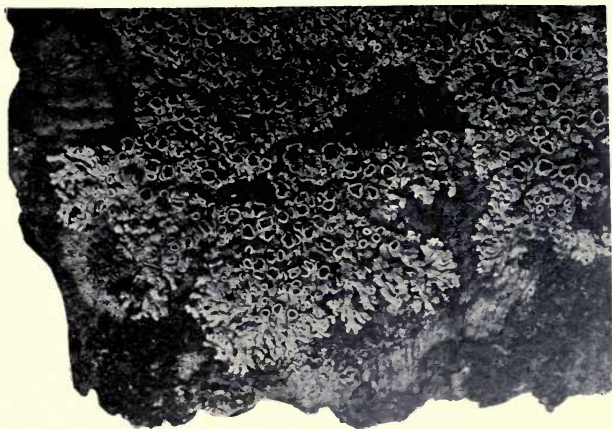


4.

1. *Physcia intermedia* var. *Wahlenbergii* LYNGE.
2. *Physcia caesia* * *ventosa* f. *convexa* n. f.
3. *Physcia caesia* * *ventosa* f. *plana* n. f.
4. *Physcia melops*. (DUF.) NYL.



1. *Physcia pulverulenta* f. *superfusa* A. ZAHLBR.
2. *Physcia intermedia* var. *stellata* LYNGE.
3. *Physcia tribacia* (ACH.).
4. *Physcia pulverulenta* var. *angustata* (HOFFM.) NYL.



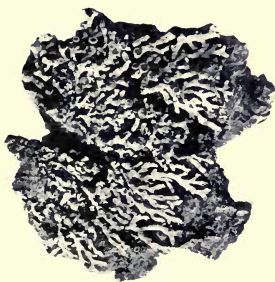
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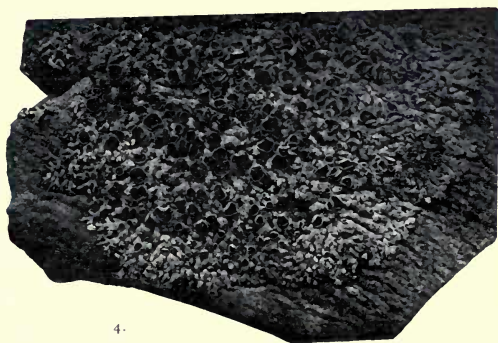
2.



5.



3.



4.

1. *Physcia aiipolia* f. *alnoiphila* WAIN.
2. *Physcia stellaris* var. *tenera* (HAVAAS) LYNGE.
3. *Physcia aiipolia* f. *anthelina* (ACH.) WAIN.
4. *Physcia stellaris* var. *rosulata* (ACH.) NYL.
5. *Physcia stellaris* var. *radiata*. (ACH.) NYL.

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